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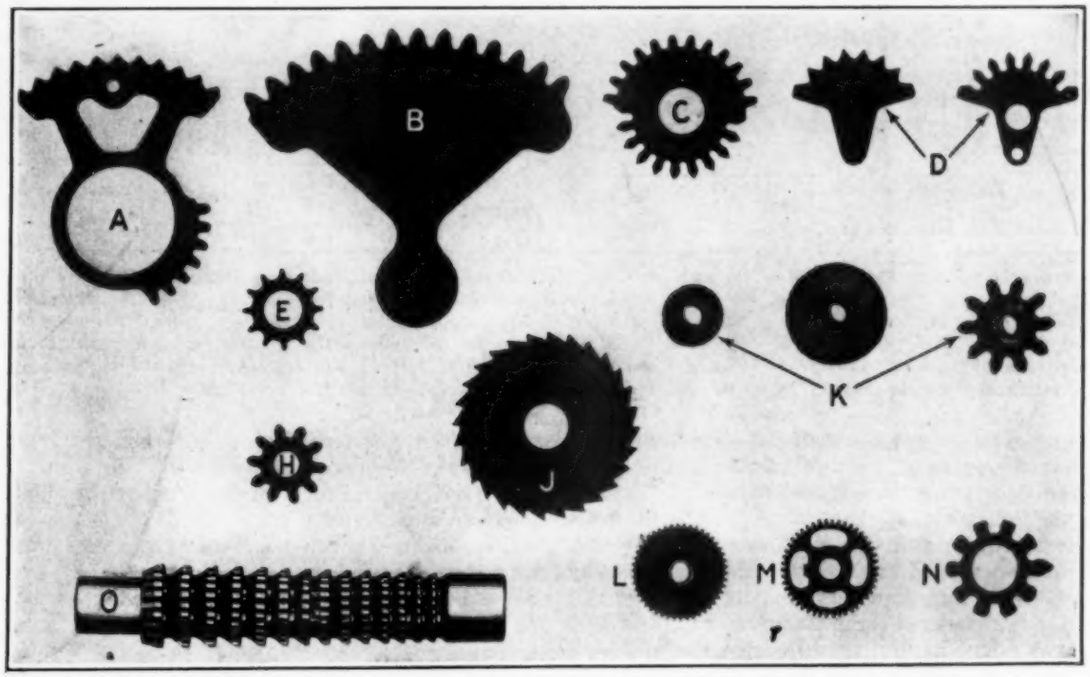

Fig. 1—A group of miscellaneous gears, segments, ratchets and sprockets made by means of press tools

Production of Gears, Segments and Sprockets From Sheet Metal

STEEL gears produced from sheet metal by means of press tools have the advantage of economy when a product can be designed to include their use. Production requirements and specifications govern the practicability of using gears of this type, due chiefly to a die cost that should be distributed over a stipulated number of pieces, and to certain limitations that determine whether or not it is possible to make the type of gear desired. No rules are available for use in connection with their manufacture other than those applied to the general run of press work.

Sheet-metal gears cannot be used when the transmission of much power is necessary, since gears for that class of work are generally too wide of face to be made in a press with any degree of accuracy. Sheet-metal gears can be used in such products as cash registers, adding machines, typewriters and meters, because the power necessary for them to transmit is very small. Accuracy as a rule is important, which, of course, is readily obtainable in sheet-metal gears.

Selection of materials is important, a half-hard punching steel being the best suited. If a soft material is used there is likelihood of the metal around the teeth tearing, whereas a hard steel will dull the die rapidly. In addition to flat material, gear teeth can be punched in screw-machine blanks, although clearance must be allowed in the dies for the hubs, or stems, of the blanks. Swaged stock also can be blanked to form a gear but care should be taken to see that the metal is not crystallized, or too hard, after it is swaged. Swaged screw-

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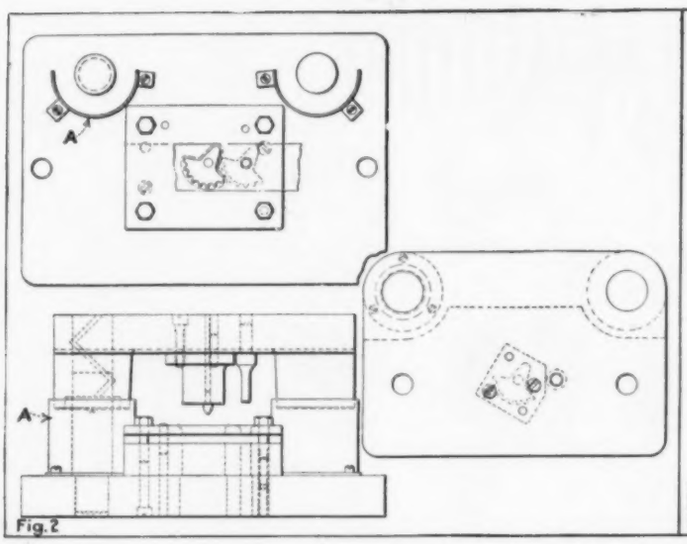

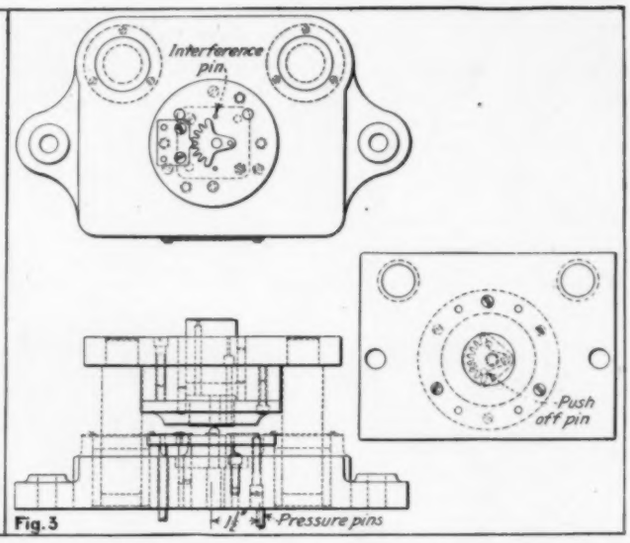

Fig. 2—Example of pillar-press tools for blanking a segment. In these tools the outer edges of the teeth are blanked, after which the tooth spaces are notched in a subsequent operation. The segments are blanked from strip metal 1½ in. wide, 0.05 in. thick and 72 in. long. 60 pieces are made from one strip. An allowance of 0.006 in. is made around the contour of the piece for shaving. Fig. 3—A compound die that pierces two holes and shaves the teeth of a segment simultaneously. The work is located from two set-edges mounted on the stripper plate. In order to avoid the possibility of inaccurate location, interference pins are placed on the stripper plate

machine parts give less trouble than those made of sheet steel, because the grain of the metal lies with the thickness of the tooth rather than against it.

Among the limitations of sheet-metal gears is the relation of the tooth form to the thickness of the metal. As a rule the thickness of the blank should not be greater than the width of the tooth at the pitch line, although a slight difference does not make manufacture impossible. The ideal condition, naturally, is to have the width of the tooth much greater than the thickness of the blank. Another limitation is the size of the hole in the blank in relation to the outside diameter of the gear. If an insufficient amount of material is left between the bottom of the tooth and the hole, the gear is likely to become distorted when punched, since there is not enough metal to give proper support during the cutting action of the die. The relative size of the gear, too, is important, but here again ordinary press rules determine the possibilities. Usually, sheet-metal gears do not exceed ¼ in. in thickness, although heavier sections may be produced if conditions are satisfactory. Accuracy of gear teeth teeth depends upon the type of die used and the precision with which it is made. If care is taken in fitting the punch and die, and in building the die rigidly, important dimensions can be held to a tolerance of 0.0005 in., although if a wider limit is set, the die will render greater life between grinds. A well-constructed die will produce upwards of 50,000 pieces during its life, depending upon the nature of the work. Then when the die has become worn beyond use, the cutting portions only need be replaced, thus reducing the cost of the second run of work. Three types of dies are applied to sheet-metal gear manufacture: the straight blanking die that punches the teeth only; a progressive die that pierces the center hole and the teeth or contour; and a compound die that blanks the piece and pierces the hole simultaneously, in one die section. Press tools of either the pillar or subpress type are usually preferable because they are more rigid and produce better results. Open dies are satisfactory, however, when the teeth are to be shaved in a subsequent operation, or when the gear does not have to be extremely accurate.

Teeth of racks, segments, ratchets, sprockets and similar parts can be formed by following the same procedures. Several of such parts, together with miscellaneous gears, are illustrated in Fig. 1, showing the variety of shapes and sizes in which the punched type of teeth can be used. At *A* is shown a segment made of material ⅛-in. in thickness, arranged with ratchet teeth at the top, and several 14-pitch spur teeth at the right. Sufficient material is left adjacent to the teeth so that distortion will not take place in blanking. The segment at *B* is comparatively plain, and is ¾ in. in thickness.

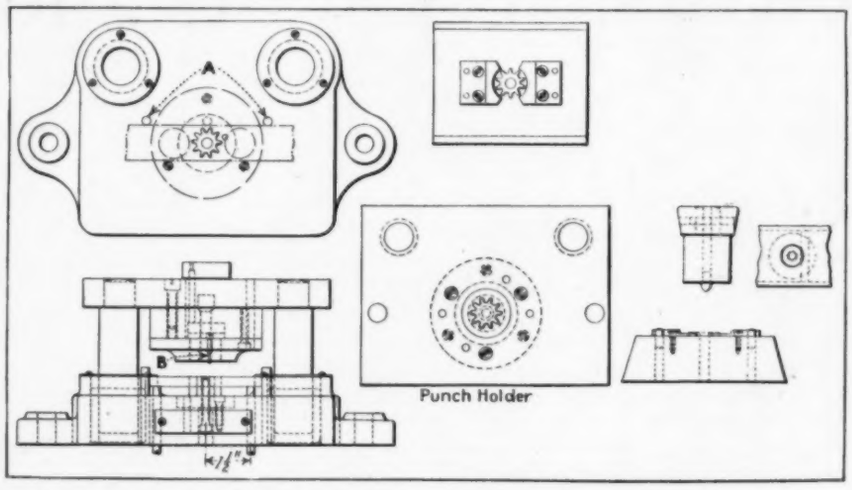

Fig. 4—A set of dies used in making a gear 0.062 in. thick and having twelve teeth. Blanking is handled in the die shown at the left, in which an allowance of 0.007 in. is made for shaving. The teeth of the gears are swaged thinner at the outer edges than at the remaining section, in the die shown at the right. The work is located by two set edges

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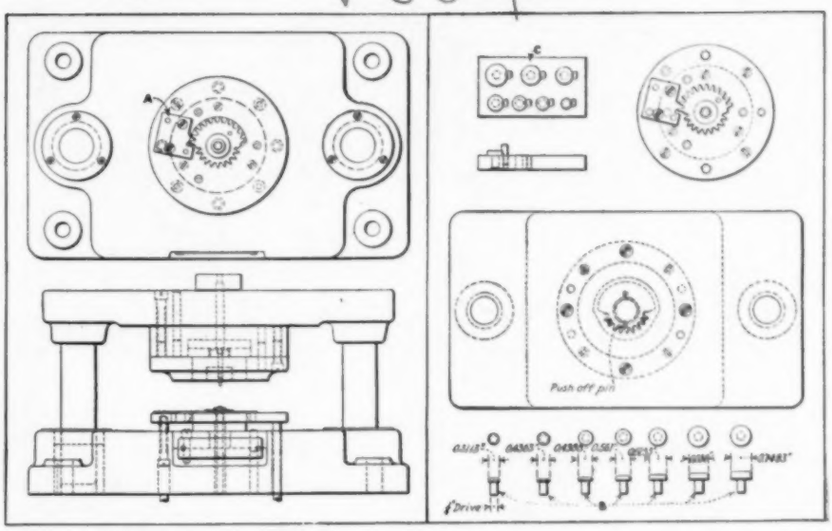


Fig. 5—Notching and shaving dies for type-wheel segments. The part is a screw-machine blank requiring three press operations to complete. One die notches the spur teeth, another the liner teeth and a third shaves the teeth. In notching the liner teeth, the work is located from a set-edge that fits the first tooth-space, the spur teeth having been previously notched. The shaving die is illustrated at the right. The segments are made in seven sizes, therefore one die is arranged to accommodate all styles by making the center locating-plug interchangeable

Teeth of this type are easily blanked because their pitch is much greater than the thickness of the metal. The double segment at *C* is made from a screw-machine blank, the outer portion of which is $\frac{1}{16}$ in. thick. At *D* is shown a segment that has its teeth made in two operations, the first of which forms ratchet-type teeth, while the second cuts the teeth to the full depth. The metal is 0.05 in. in thickness.

Another gear made from a screw-machine blank is illustrated at *E*. It has twelve, 12-pitch teeth $\frac{1}{16}$ in. thick. The gear at *H* is of the plain, flat type, although the teeth are swaged thinner at their outer edges than in the remaining section. The ratchet at *J* is made of $\frac{1}{8}$-in. material and has 28 teeth. An example of a swaged gear is shown at *K*, the left-hand piece is the screw-machine blank from which the gear is made. It is $\frac{3}{4}$ in. in diameter. The center piece shows the swaged blank, $1\frac{5}{16}$ in. in diameter, while at the right is shown the finished gear having a thickness of $\frac{3}{32}$ in. The upper face of the hub is formed with four ears and a spline, to the former of which a cup-shaped sheet-metal dial is to be assembled. At *L* is shown a gear having smaller teeth than the other examples, although the tooth thickness does not exceed the thickness of the blank. It is made from a screw-machine part and has 26 teeth. The outer face is $\frac{1}{16}$ in. thick, and $1\frac{3}{16}$ in. in diameter. The teeth of the gear at *M* likewise are small, although the gear is made of flat material, $\frac{1}{32}$ in. thick. It is $1\frac{1}{4}$ in. in diameter and has 35 teeth. At *N* is shown another gear made from a swaged blank $\frac{1}{8}$ in. thick. The outer portion is reduced to $\frac{1}{16}$ in. in thickness.

Broaching Internal Gear Dies

In constructing dies for small gears, making impossible the use of a gear cutter for forming the teeth, and in cases where odd-shaped teeth are required, the practice is to use a broach to form the internal gear face, or the irregular opening. An example of such a broach is illustrated at *O*. If replacement dies are made, the same broach is used, therefore, the cost can be distributed over a greater number of parts.

In blanking a gear by press tools, the action of the punch and die is such that clean, smooth cutting takes place for a distance less than half the thickness of the blanks, the remaining portion being sheared. Therefore, the teeth have a somewhat ragged appearance. On thin material this condition is not so noticeable as it is on parts having a thickness of $\frac{3}{32}$ in. or more. To overcome this condition, it is necessary to shave the teeth in subsequent operations, using tools of the pillar type. Usually one shave is sufficient to produce a smooth, true contour throughout the tooth thickness. Sometimes, however, in making the thicker type of gears, it is necessary to shave the teeth twice in order to eliminate shear marks. A suitable allowance for gears requiring one shave is 0.0035 in. of metal around the tooth contour for each $\frac{1}{32}$ in. of thickness. When two shaves are required this amount of allowance is increased slightly so that the first shave takes off about 66 per cent of the total allowance, while the second shave takes off the balance.

Producing a Segment Gear

A plain blanking die used in making the segment shown at *D* in Fig. 1, is illustrated in Fig. 2. The material from which the blanks are cut is $1\frac{1}{2}$ in wide and 72 in. long. Sixty pieces are made from one strip. Two leader pins are mounted in the die-shoe, having the safety guards *A* attached as shown. An allowance of 0.006 in. of metal is made on the contour or teeth of the blank for shaving. The third-operation die illustrated in Fig. 3, is of the compound type and is arranged for piercing the two holes, and shaving the teeth. The die for notching the teeth, constituting the second operation, is constructed along similar lines. Two set-edges, or nesting plates, locate the work, one from the hub and the other from the center tooth spacing. Interference pins are placed on the stripper plate, which surrounds the punch, so that the work cannot be located inaccurately by one of the other tooth spacings. In handling work of this class, it is necessary to arrange the location of the part so as to have the flat side of the blank adjacent to the punch when being shaved.

Press tools for making the gear shown at *H*, Fig. 1, including blanking and swaging operations, are illustrated in Fig. 4. The blanking die at the left is of the compound type, arranged to pierce the center hole to 0.236 in. and to blank the gear as outlined. The material is 0.062 in. in thickness, $1\frac{1}{4}$ in. in width, and 72 in. in length, permitting 69 blanks to be made from one strip. Two pins *A* guide the stock through the die, and an automatic-feeding device attached to the bolster is used to feed the strip across the die face. The push-off pin *B* strips the blank from the punch on the upward press stroke if it should stick to the punch face. An allowance

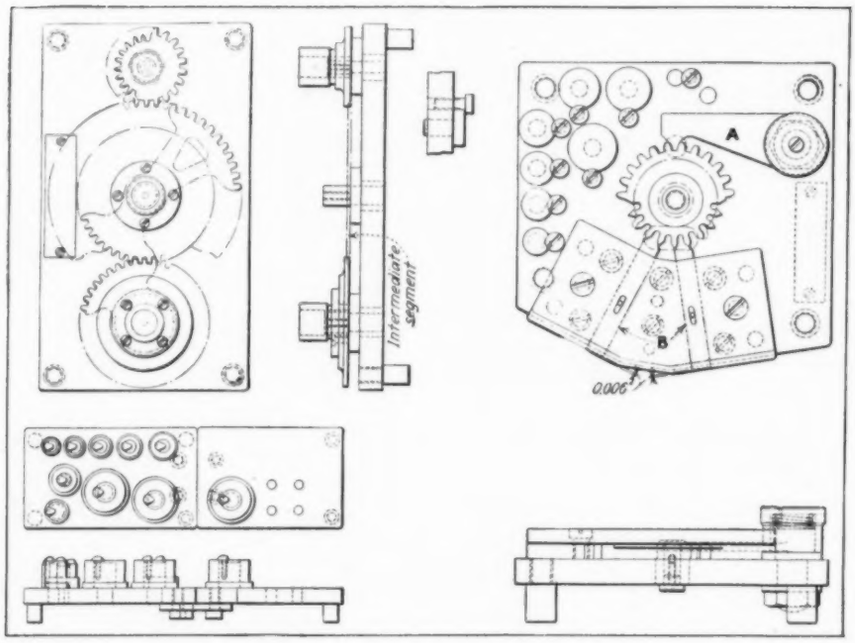


Fig. 6—Some of the inspection gages used for checking the teeth of a segment. At the left is a gage of the running-in type which uses an intermediate segment so that it simulates, in inspection, the action of the parts in service. The gage at the right is a shaving gage used in checking the relation of the spur teeth to the liner teeth. A spring pawl and two flush-pins are used for this purpose. Holes located in the base of the gage permit a visual inspection of the contacts

of 0.007 in. around the contour of the teeth is made for shaving. The open-type die, illustrated at the right, swages the outer edges of the teeth to a thickness of $\frac{1}{32}$ in. It is of plain construction, employing two hardened die blocks as its main units. After swaging, the gear is shaved to the proper outline, and the hole is shaved to 0.25 inch.

Type-wheel segments, such as the one shown at *C* in Fig. 1, have their teeth formed in three dies, namely: a notching die for the spur teeth; a notching die for the liner teeth; and a shaving die that trims the contours of both sets of teeth simultaneously. The die for notching the liner teeth is illustrated in Fig. 5 at the left. Inasmuch as the spur teeth have been notched, the blank is located by the set-edge *A* that fits the first tooth spacing. Constructional features of the die are somewhat the same as preceding examples, with the exception that a different form of die-shoe is used. The segments are made in seven sizes, the only difference being the hub construction, therefore, one die is arranged to accommodate all styles by making the central locating plug interchangeable. At *B* are shown the various plugs used, while at *C* is illustrated the block in which they are mounted when not in use. An allowance of 0.007 in. is made around the teeth for shaving. Location of the segment for the first notching die is obtained from the hub hole, and a locating pin mounted on the punch fits a corresponding hole in the blank.

Shaving the teeth is handled in the die illustrated at the right, utilizing a similar type of die-shoe assembly. As may be seen, constructional features are similar to those in the notching die, the main difference being the construction of the punch and the die-block. Accommodation for the different sizes of segments is made by individual locating plugs also mounted on a block such as used in connection with the notching die.

Inspection gages for punched gears are made to include the testing features required for any type of gear. Some of the gages used for checking the teeth of a segment are illustrated in Fig. 6. The gage at the left is a running-in gage, which has an intermediate segment for the purpose of simulating in inspection the action of the parts in service. Master segment-gages are maintained for the different inspections, and a complete set of interchangeable locating studs is available, thus making the gage capable of handling the various segments manufactured. The gage at the right is a shaving gage that checks the relation of the spur and the liner teeth to each other. The work is fitted on a locating plug mounted in a hardened bushing, and the spring pawl *A* is adjusted to one of the spur teeth, as shown. The flush pins *B* are adjusted to the liner teeth, so that the spacing of the teeth, and their depth in relation to the center hole can be ascertained. Holes are provided in the base of the gage directly under the contact points of the flush pins, and of the spring pawl, enabling a visual inspection of the contacts to be made.

Illustrations and data for this article were obtained through the courtesy of the National Cash Register Company.

MEETING THE PROBLEMS OF THE CONTRACT SHOP

In an early issue we begin a series of articles on the contract shop and its problems. We believe that the well-regulated contract shop is an important part of our industrial system, and that many of the small contract shops of today will be amongst the big production plants of tomorrow. In the preparation of these articles numerous shops in different parts of the country were visited, and it is the aim to point out some of the high points of successful contract shop management and practice. The first article of the series will describe the classes of work being undertaken by these shops, the methods of handling the order, and the general organization for the work. Other articles will deal with the plant layout, equipment, supply of materials, and personnel problems of the successful shop.

How Can I Regain "Dull Time" Overhead?

WILLIAM HOLLAND, business consultant by way of hobby, was not at all surprised to discover in his mail this letter from an executive, unknown to him except through the product of the concern represented:

We are much interested in figuring the cost of our product during dull times as well as when business is good.

We figure our overhead as a percentage of the actual labor cost. The overhead expenses in dull times are, of course, much higher relative to the machines and equipment sold than during periods of prosperity.

Should the customer who buys during dull times be charged on the basis of the extra overhead? Or, if necessary to maintain uniform price, should the customer who buys during periods of prosperity be charged with the dull-time overhead rate? One or the other, or the equivalent, must be done because of the small margin of profit obtainable on our product.

As a corollary to these questions, please consider another: During a period of depression is it good business practice to accept orders for special machines when the total cost is more than the price charged, with the advantages that the men are retained and the overhead is less than if we were not doing any work at all?

"Here are the same old questions bobbing up," mused Holland. "And they are important, too. Wonder if any great number of people ever solved them to their entire satisfaction. Guess the best thing I can do is to send this gentleman a copy of Frank's letter. Miss Haines, get me a copy of Frank Whittaker's letter, please—Whittaker Machine Company." When he received the letter, "Let's see if Frank covered all the points."

You will remember, Bill, that about four years ago you and I discussed the matters of overhead, cost of product, selling price, and so on—their relation to each other and to the amount of business done. I was skeptical of your suggestions, but having no better proposals tried them. You will be glad to know that they have worked out splendidly in my case.

The first thing I did was to average my costs over a number of years, including the proper proportion of slump and prosperity periods, weighting each year's costs according to the value of the dollar of the time. To the average cost I added the profit I expected to get and thus determined the selling price. Of course overhead was included in my costs, but since I had all the actual cost figures it didn't worry me.

The preceding statement tells you briefly and in a general way what I did, but of course there were details that need explanation. More should be said about overhead, for example. On my regular product, "bread-and-butter" stuff, or so-called standard lines, I charge an average overhead, determined by experience, as I said. On my special work I charge actual overhead expended on that particular work. Have found that I can determine it rather accurately, too. I use the monthly statements of the cost accounting department to check my average and special overheads and sometimes a slight adjustment in selling price is necessary. Under ordinary business conditions such an adjustment is made every six months. I express my overhead in percentage of direct labor, as most manufacturers do—and for the same reason, namely, that direct labor accounts for the greatest part of our prime costs. An important advantage of so expressing the overhead is the assistance furnished thereby in estimating, and in the control of the overhead itself.

"So far so good," thought Holland. "As I remember it he said something about competition. Yes, that's next."

You may wonder how I compete if other makers of my products cut under my prices. I have two remedies for that and so far they have brought results. In the first place I don't sell on price—but on what my machines will produce for their owners in the way of both quantity and quality. In the second place, I keep my shop methods and equipment up to the minute. Possibly I'm mistaken, but I don't think any one of my competitors can touch me on cost. That comforting situation, coupled with the fact that I actually get higher prices, gives me a nice margin of profit, a part of which, incidentally, I use to pay the higher salaries of my salesmen, who must be better than the average to sell in accordance with my policies.

You see, if business drops off altogether I can shut up shop. But I don't, because I well know the value of my organization. So I keep on just as many as possible, letting them get things repaired, cleaned, and so on, and I even take on special work with the intention of sacrificing some of my profit ideals, if necessary. I don't do this with the idea that it lowers my overhead—never could see that my overhead is any lower when I'm doing work at a loss—I do it just to keep the gang together and to be ready to render my usual kind of service and give prompt delivery the minute things open up. Certain salaries, certain kinds of taxes, the insurance on buildings and equipment have to be paid whether there is a wheel turning or not, and any loss of sales is just that much more expense to be absorbed. I go at that with my eyes open. At the same time I concentrate on the problem of reducing overhead. I have more time than ordinarily to give to the task, for one thing; and besides that, expenses chargeable to overhead stand out mighty plain in dull times. My experience has been that certain activities growing up between slumps can be dispensed with—when we are pressed to lower costs.

Are these theories really sound, Bill? It's because you put them into my head, old man, that they are being used. Am I just fortunate in making them work out so far, or are they the solution everyone has been hunting?

I'll not apologize for the length of the letter because I know it's just as interesting to you as a detective story is to most men.

Yours,

FRANK.

Mr. Holland smiled with satisfaction as he fin-

ished Frank Whittaker's letter. "Might look like a peculiar coincidence, having this thing right at hand to answer that inquiry. It isn't, though, because those very questions are worrying a lot of people. I'll send him a copy pronto."

Executives are invited to discuss the problem involved in the foregoing case. Accepted contributions will be paid for.

Discussion

Depreciation Reserves

The commonest advice a consultant gives is to buy new machinery. Now suppose Mr. Jones did buy new machines for his shop and tried to put a product on the market that nobody wanted. Would the new equipment do him any good? It may be that the design of the machines Mr. Jones wanted to sell was out of date, although he did not know it. I would also ask Mr. Jones if his product was standardized.

It is getting quite popular to advise everybody to buy new machines. I would investigate many other conditions before I advised anybody to do so. Perhaps the old ones were not used to their full capacity. After I had investigated the design and the number of sizes of the product, I would find out whether or not suitable jigs and fixtures were used. Then I would also investigate the way transportation was carried out.

I do not object to new machines if an investigation proves that they are necessary, but there are many other less risky means by which one may cure bad business, including the possibility of speeding up production by better utilizing the time. —A. E. FRISTEDT, *Sweden.*

How Determine Allowance for Parts Ordered Omitted from a Machine?

While there is undoubted sincerity of intention in Mr. Holland's suggested solution of subtracting from the list price of the complete machine the factory cost of the crankshaft, including overhead, and allowing the agent to take his discounts from the latter, I am inclined to favor the manufacturer's original solution of deducting 15, 10 and 10 from the list price of the crankshaft, then deducting the balance from the list price of the press and from what is left figuring the agent's discount of 15, 10 and 10. While this may seem a little harsh at first glance, the cost of special orders is never underestimated, and the sooner we get customers away from the viewpoint, or any phase of it, that the sum of the cost of the separate parts should only exceed the cost of the complete machine by a small percentage, the better off we'll all be. If the manufacturer is too considerate of the agent in such matters, the abuse will only grow.

If the reason for ordering a press less crankshaft was that a worn crankshaft was still available from an old machine, a little fundamental reasoning on the agent's part would soon have brought out the fallacy of the so-called economy in handicapping an otherwise perfectly conditioned press, and resulted in a regular order. If a new crankshaft was on hand as a spare replacement part, the agent could have demonstrated the economy of keeping it so, and ordering a complete machine. If the full discounts were taken before deducting, as the manufacturer proposes, this would undoubtedly have been a clincher argument for the agent.

To give the agent the "inside" on manufacturing costs is not wisdom, as there are many factors beyond his understanding which at times may cause the differential between costs and price to him to vary, and it only gets him in a questioning frame of mind. Better to perhaps "peeve" him for the moment, if it's necessary, to get him concentrated on selling regular orders—a worthwhile habit for him to develop for all concerned.

—GEORGE E. GERGELY.

The Privileged Class

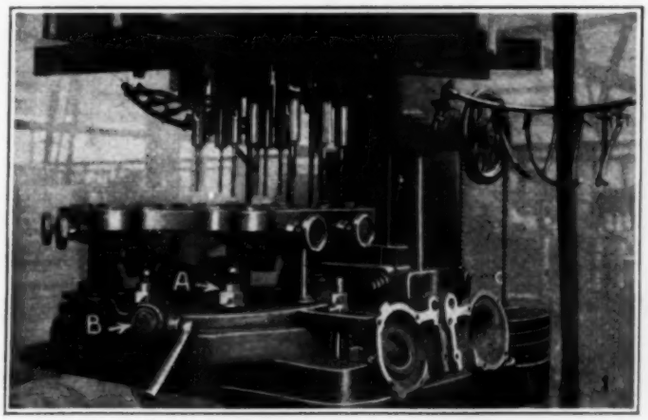
Plant executives spend large sums of money each year for new shop equipment, but the engineering department, the mainspring of the whole plant, is usually neglected when appropriations are being made.

Antiquated methods of making drawings can delay a job as well as laxity on the part of the chief draftsman.

There are still some drawing rooms that don't know what a drafting machine looks like. The system that calls for inked-in tracings is still in effect in quite a number of places; the method of making designs on vellum paper, using a soft pencil and eliminating the inking in, evidently hasn't reached them. Then again, lots of time is wasted in not having certain items standardized and put up in chart form for easy reference. The writer also has in mind a drawing room that had no index for its few hundred tracings, which meant looking through the whole pile to get the tracing desired.

One can easily understand that lack of proper tools in the drawing room can affect production the same way as poor shop equipment; and the first question asked the chief engineer should be in relation to the methods he uses in getting drawings to the shop.

—SAMUEL KAUFFMAN.



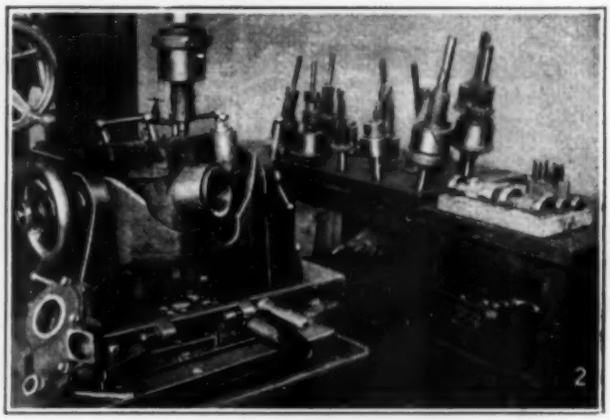


Fig. 1—Drilling six bolt holes in each half of the steering-gear case. Fig. 2—Boring the main holes in the gear case

Building and Assembling the Lancia Steering Mechanism

By J. A. Lucas

MALLEABLE iron is used for the case that houses the worm and wormwheel of the steering mechanism. Both halves of the case are shown on the table of the multiple-spindle drilling machine in Fig. 1. After the mating surfaces have been ground, the six bolt holes are drilled while the parts are held in the fixture shown. The faces of the cases are held in contact with the under side of the bushing plate by means of suitable jacks, as at *A*, and the castings are positioned by the knurled-headed screws shown at the side. The indexing fixture holds three pairs of castings and is held in the proper drilling position by the index pin shown at *B*. The drilling time for each pair of castings is 10 min. In Fig. 8 details of the fixture are given. After a few minor operations, the halves of the case are bolted together and are placed in the trunnion type fixture shown in Fig. 2, for boring and reaming the main holes. All of the tools are provided with guide collars and, with the exception of the drills, they are piloted at their lower ends. The fixture, in addition to being mounted on trunnions, has a sliding base that is positioned by the stops shown in front, and is moved by the crank handle in front of the stops.

The construction of the fixture is somewhat unusual, the cover plate being provided with bar handles by which it can easily be lifted. A few of the constructional details are shown in Figs. 3 and 9, the section at *A* showing the angle at which the case is bored, while *B* shows the jaws used in gripping the projection by which it is fastened to the chassis. The trunnions on the jig allow it to be swung into position for boring both the main holes. All the tools shown at the right in Fig. 2 are required for this job. The time for the operation is 50 minutes. The steering is done by a five-lead worm and a worm gear, as shown in Fig. 4, where they are being ground together, using fine abrasive and oil. Any desired load can be put on the wormwheel by means of the brake shown at the

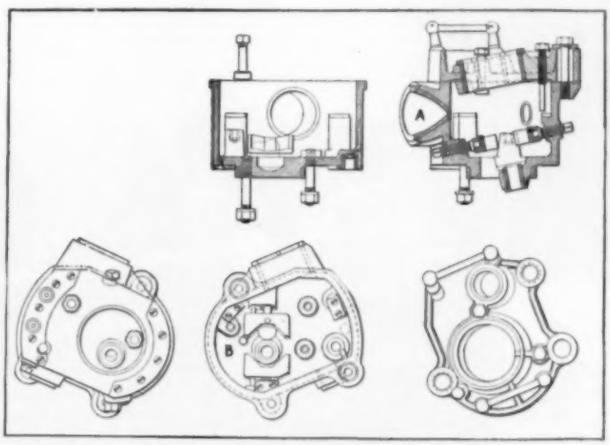


Fig. 3—Details of the fixture illustrated in Fig. 2. The section at A indicates the angle at which the case is bored, while that at B shows the jaws for gripping the projection by which it is attached to the chassis

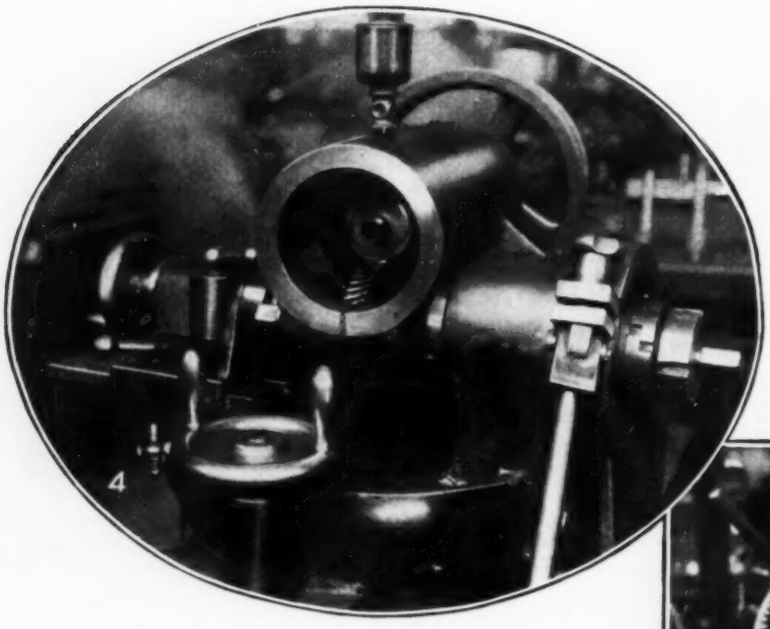


Fig. 4—Machine used in rough grinding the worm and wheel together, in order to insure smooth action. This machine permits the center distance between the worm and the wheels to be measured and varied so that correct center distances are insured in the finished gearing. The brake at the right enables any desired load to be placed on the worm wheel shaft

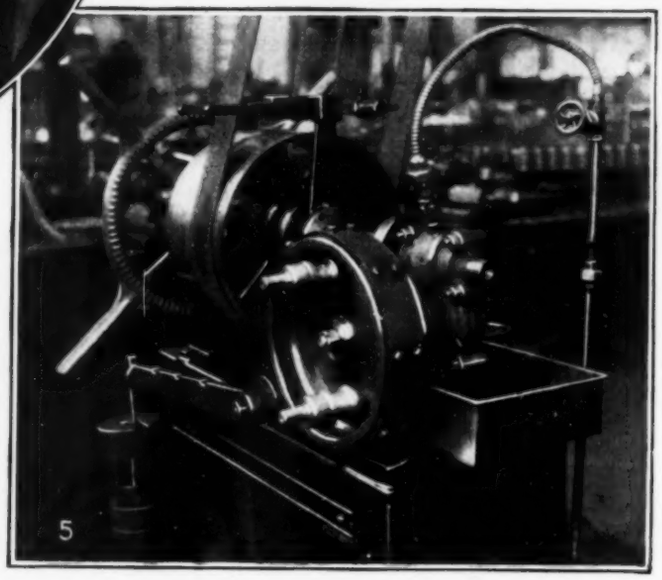


Fig. 5 — The second grinding operation after the worm and wheel have been mounted in the case. A constant supply of very fine grinding compound is provided by means of piping. Any desired load can be placed on the worm gear

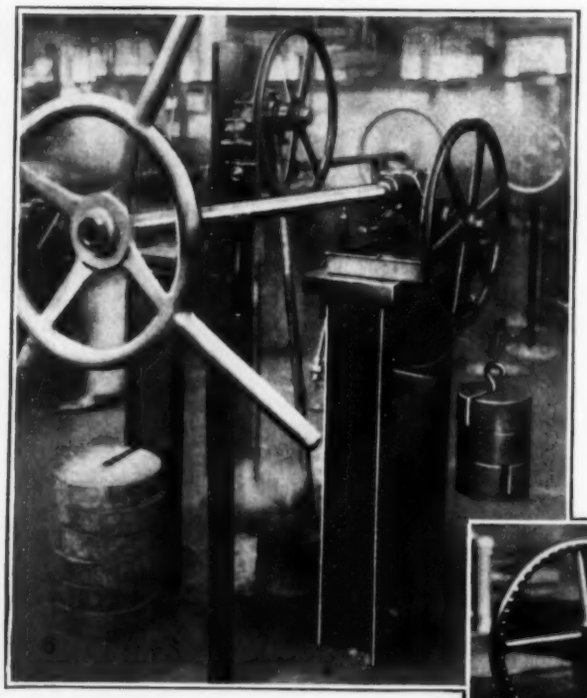


Fig. 6—A stand for the final grinding in of the worm and gear. An even finer abrasive is used in this operation and the load on the pulley, which represents the steering arm, is varied as the work progresses. This operation requires from 15 to 45 minutes, and secures a very smooth action between the worm and the wheel

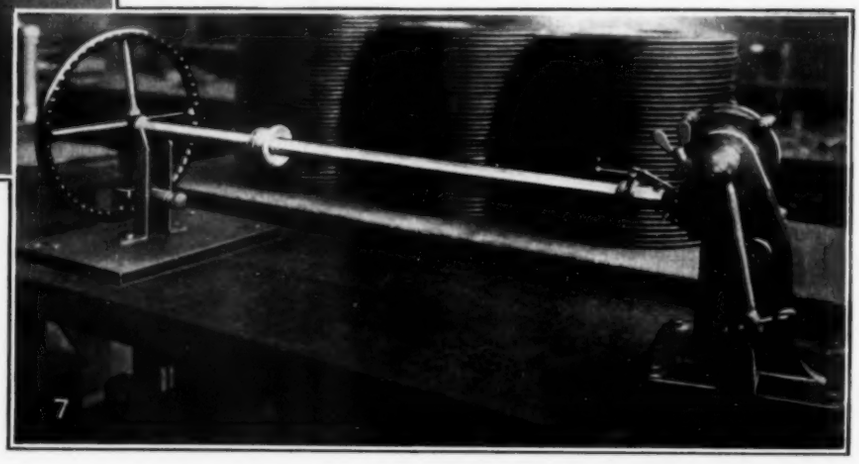


Fig. 7—Final test of steering gear before assembling in the car. The steering column is placed in the fixture and the steering wheel is held by a fork over one of the spokes. The steering arm is then set to the desired angle by the gage shown at the other end

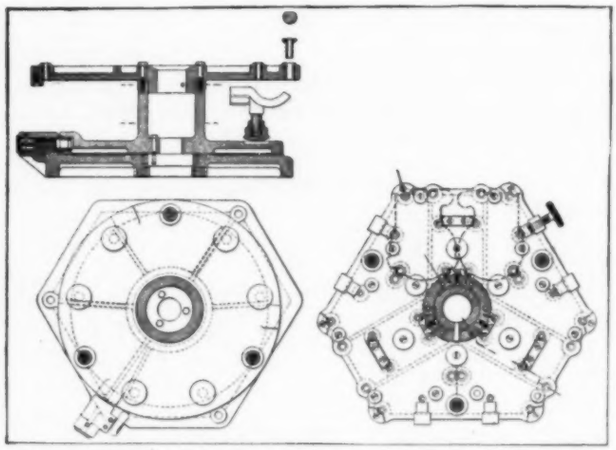


Fig. 8 — Details of the fixture used in drilling the cases. The method of locating and locking the work, and the three stations for loading, drilling and removing the work are shown

right. When in operation, a cover containing a bearing for the front end of the worm goes in the opening shown in front, this cover having been removed to show the mechanism more clearly. While in this machine, the center distance between the worm and the wormwheel can be accurately measured. The usual grinding time of this operation is 5 minutes.

Following this operation, the worm and wheel are mounted in the case, as shown in Fig. 5, where the second grinding takes place. A very fine compound is used, its continuous flow being secured through piping. The brake wheels on the gear shaft can be loaded to any desired point by means of the lever and weights shown. The pilot wheel at the end can be clutched-in while the belt is on the loose pulley, so that the operator can turn the worm by hand and feel the smoothness of its action.

After the last machine grinding, the gear box is brought to the hand-operated grinding machine shown in Fig. 6. All further grinding, or working in, is done by hand. Here, too, the operator feels the smoothness of action of the worm, and also the amount of effort

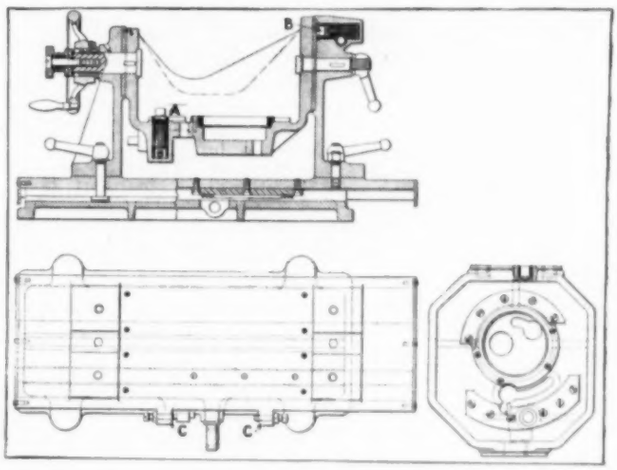
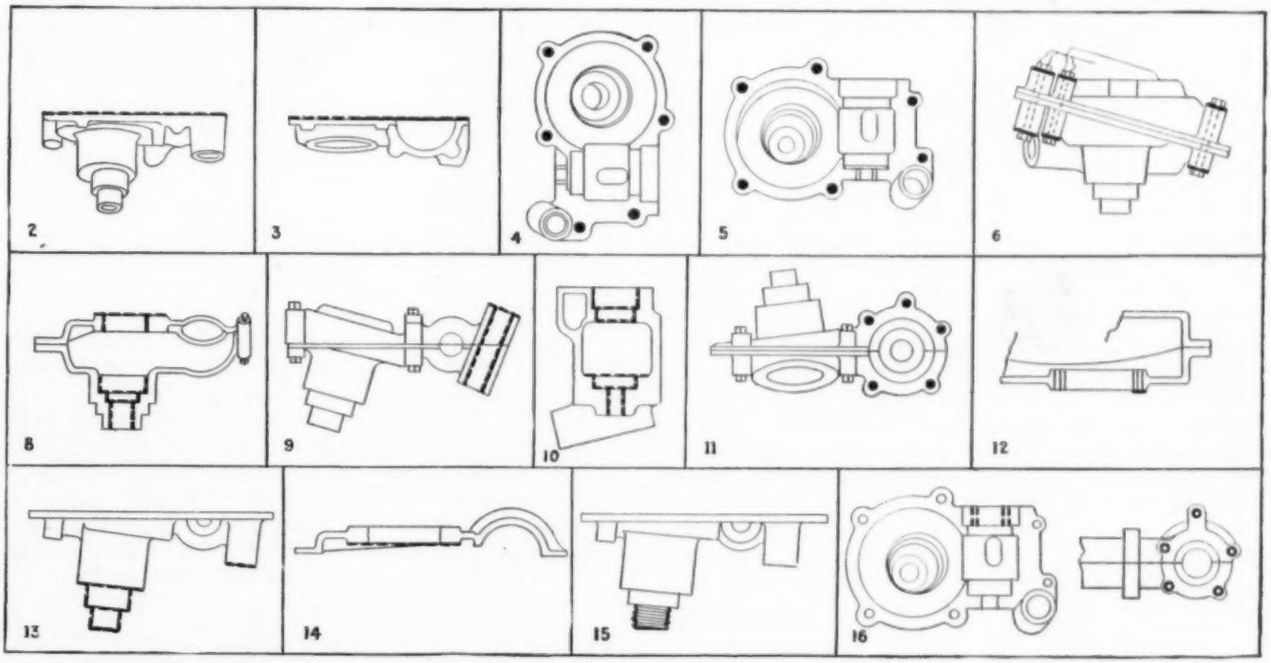


Fig. 9—Construction of the trunnion fixture that carries the work holding part, Fig. 3, showing the pins that permit the fixture to be indexed in both directions, and the traversing rack and pinion



The diagrams show most of the major operations. The sequence of operations is given below

1—Inspection of castings. 2—Grinding right side of case. 3—Grinding left side of case. 4—Drilling 6 holes in right case. 5—Drilling 6 holes in left case. 6—Spot facing for nuts. 7—Hand tapping and assembly. 8—Facing on boring machine. 9—Boring gear wheel bearing. 10—Boring for worm seat. 11—Drilling grease cover holes. 12—Drilling stop pin hole. 13—Turn and face hub. 14—Bore inside of case. 15—Threading the hub. 16—Hand tap and burr holes

necessary to raise the weight shown from the floor. During the hand grinding, the weight to be lifted is gradually increased, the maximum being between 55 and 60 lb. The operation requires from 15 to 45 min. to secure the smoothness of action desired. Tests are made so as to be sure that the movement is sufficiently free to enable the driver to turn the wheels while the car is standing still, without undue effort. Provision is made for adjusting the center distance between the worm and wheel by means of an eccentric.

After being finally assembled to the steering column the whole steering mechanism is mounted on the stand shown in Fig. 7, and the various dimensions are tested. The illustration shows how the steering wheel is held by a fork over one of the spokes while the steering arm is adjusted to the proper position on the wormwheel shaft.

Referring again to the drilling operation, details of the indexing fixture used are shown in Fig. 8. The drawing shows how the halves of the case are held and drilled in pairs at one station. The two other stations give ample time for loading and unloading the work before and after drilling.

The construction of the trunnion part fixture shown in Fig. 2, is given in some detail in Fig. 9. The pins that index the work holder in both directions are at *A* and *B*, the trunnion locks showing at each end. The fixture is traversed on its base by means of a rack and pinion, the distance of traverse being indicated by the stops shown at *C*. The fixture is locked by T-bolts and handled nuts.

Johnson Jolts Free Service—*Discussion*

By E. F. DuBrul

THE *American Machinist*, current volume, carried an editorial, page 390, and an "Old Man Johnson" story, page 368, on the topic given above. These articles raised the question of who is going to pay for the greater servicing that modern machine tools require.

The increased complexity of machine tools transfers the skill of the designer to the machine and thereby makes possible the use of less skilled mechanical operators. At the same time it increases the necessity of servicing the machines because the less skilled operators cannot do it. Then, too, the users of such machines simply cannot find enough service men who are highly skilled in the peculiarities and kinks of all the different types of machines that a large factory now employs. They therefore must call on the builders of the machines for this service.

This is a plain fact that both the builder and user must recognize. The builder must organize his affairs so as to be able to provide this service. But there isn't any Santa Claus who will or can give the user of the machine tools, without cost, all this service which the user himself requires under the present condition. The question then is, "How is this service cost to be collected?" Is it to be included in the original price of the machine, or is it to be paid for as a direct charge?

Why should not everybody understand that machines are machines and service is service? Machines, therefore, should be charged definitely to the buyers who get the machines, and service should be charged to the users who get the service. Clear thinking on this point and a spirit of fairness all round make it apparent that servicing of machines should be paid for by the man who calls for the service and not by anyone else.

It seems evident to me that attempting to include it in the original price of the machine is the worst sort of business policy for both the user and the builder. Some users will not require service on certain machines. They have men who know something about certain machines although they may not know as much about others. The builders of the machines that the user's men know all about will not be called upon to render service to such users. There are users who are more careful in training operators, or who do other things that reduce the amount of servicing required by them. It is unfair to such users to give other users service at their expense by including it in the price of the machine.

But is it even possible to collect from today's buyer the service he will ask for during the life of the machine? Does not clear thinking show that it is tomorrow's buyer who will pay for servicing the machine bought today, unless servicing is charged to the man who gets it done? So every service gotten without charge is paid for by some other buyer for the most part.

Asking Too Much of a Builder

Let us throw some more cold light of reason on this question. It certainly is a fact that if the builder were to undertake to furnish all the service required for a machine tool during its economic life without charge, he would be insuring service to that machine for its life, but for a sum that cannot be calculated. This is asking a machine builder to undertake a job that is very bad actuarial practice on its very face. He does not know what the cost of service is going to be during the economic life of the machine. Neither the buyer nor the seller knows whether the builder's business will even continue during that economic life. If he goes out of business the service that the user paid for in advance will not be rendered. But the money paid for it will have been dissipated or spent in other ways and the user will be out of pocket to the extent of this service charge if it is concealed in the price of the machine.

It strikes me that only a very trustful and unwise buyer would wish to pay for service insurance on that basis, and only a very foolish seller would sincerely undertake to furnish service on that basis. It strikes me that the only frank, open, truthful and sensible way to handle this problem is to strip it of all the bunk that has grown up around it, and get down to hard pan.

"There is, to my mind, no economic failure so terrible in its import as that of a country possessing a surplus of every necessity of life with numbers, willing and anxious to work, deprived of those necessities. It simply cannot be if our moral and economic system is to survive."—Herbert Hoover.

Apprenticeship in Dull Times

Getting Started

By C. J. Freund

Apprentice Supervisor, The Falk Corporation

"YES, we have been thinking about apprenticeship for a long time. In fact, we have made some very definite plans for courses and administration. But we can do nothing just now. Business is not so good, as you know, and for the time being we can do nothing in this direction. However, we assure you that we shall put on apprentices as soon as we get in a few more orders and our work picks up again."

How often have apprenticeship committeemen, educational directors of manufacturers' association and others heard these words or others just like them.

There has been much agitation in favor of apprentice training in the last ten years and a widespread interest in the question has developed. There is a positive need for apprentice training in American industries. Census statistics prove that a good many more mechanics are lost to our manufacturers every year than are gained and, although the proportion of skilled men required for production manufacture is less than for old-fashioned methods, the fact remains that the absolute number of trained men needed every year is constantly increasing. Also, American young men display an increasing tendency to enter clerical and commercial rather than industrial occupations. In fact, no fundamental argument can be advanced against apprenticeship.

> " . . . every American manufacturer is confronted with the responsibility for training his share of the mechanics who will be required in years to come."

Because of these conditions every American manufacturer is confronted with the responsibility for training his share of the mechanics who will be required in years to come. Most manufacturers admit this responsibility in theory. Their failure to begin the training of young men is not so much because they are opposed to the plan as due to a natural tendency to postpone—a certain inertia—which seems to affect all mankind in a greater or less degree. Every manufacturer is firmly determined that some day he will train young men for his business. But most of them seem to be equally determined that "just now" is not an opportune time for getting started.

The promotion of apprenticeship has been highly developed and employers who believe in apprentice training, or at least cannot refute the arguments in favor of it, are hard pressed to find good excuses for putting off the establishment of apprenticeship when they are urged to get busy. The old favorite excuse, the last, and to their minds invulnerable, defence, the one to which they retreat with confidence when they have been beaten on every other issue, is the argument of poor business conditions. They seem to take it for granted that apprentices are necessarily a burden which an organization can bear only under prosperous circumstances.

It requires little thought to bring out the fact that the institution of apprentice training is not only possible in dull periods but that dull periods are precisely the time when apprentice training may be started most advantageously.

In the first place, the institution of apprentice training requires the best thought of the best men in the organization, executives, superintendents and department heads, and foremen, for a considerable period of time. Apprenticeship means more than hiring boys and putting them to work. The apprentice courses must be carefully thought out and laid down before the first boy is hired. There must be conferences, many of them, to determine the trades which are to be taught, the method of teaching, and the facilities which are available in the plant for providing adequate apprentice work. Arrangements for supervision must be completed and an apprentice department must be established. School instruction must be provided for. Apprentice quotas for the various trades and departments must be decided upon. Still more time and effort will be needed to instill the principles and the spirit of apprenticeship into the entire organization. It will be futile to engage apprentices if only the management and a few officials here and there in the organization favor the undertaking. In fact, a few influential skeptics in the organization can easily destroy that unanimous abundance of enthusiasm which is required for successful apprenticeship. Accordingly, the best men must incessantly talk apprenticeship throughout the entire organization until they have built up an eagerness to get started which is an excellent preparation for the engagement of the first apprentice and a requisite for success.

All this takes time, the time of all from the highest executives down to the straw-bosses and mechanics. For many weeks the thought and discussion of and preparation for apprenticeship will need to be their principal interest and occupation. Certainly it is only in dull business periods that manufacturing officials find the time to prepare properly for the establishment of apprentice training. At other times they are so occupied with problems of production that their plans for apprenticeship may be slipshod and failure is likely to result.

Again, after the first boys are hired, the undertaking must be carefully nursed through the first painful weeks and months. Apprenticeship, like every other enterprise, is in greatest danger at the start. Difficulties and dis-

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The first of two articles. The second will be published in an early issue.

couragement will arise. The apprentices may accomplish less than was expected of them, school periods and other training features may break up the regularity of their work, foremen may find it more difficult to handle apprentices than regular employees, and the enthusiasm for the undertaking which has been so carefully and so laboriously built up may wane considerably. Until the organization has been adjusted to the presence of the apprentices and their own good work has converted the artificially stimulated enthusiasm for apprentice training into a natural and permanent conviction, the work will require more time of executives and officials than is available when business conditions are favorable.

The objection will be made that the addition to a working force of a number of apprentices at a time when the force must be kept at a minimum cannot be justified. This objection loses most of its weight when compared with the advantages in favor of inaugurating apprenticeship in dull periods which have been enumerated. Moreover, it is expedient to engage only a very few apprentices in the beginning until the institution has become firmly imbedded in the organization. It is good to start with one or two boys in a plant of ordinary size and, unless the establishment is on the verge of ruin, the addition of a boy or two to the payroll is no appreciable burden. A few boys, carefully selected, will carry apprenticeship along until business revives and then more boys can be brought into the shop as more work comes in until the quota which has been determined is attained.

It requires a higher and better type of boy for the beginning of apprentice training in a plant than after the system has been thoroughly established. When apprenticeship has become a vital part of the organization and is completely taken for granted, a few boys of mediocre caliber will be carried along with little difficulty by superior comrades and will be tolerated because men of ordinary ability have a place in industry as well as those who are more capable. However, in the infancy of the project, there are problems enough without those which a troublesome young man will bring into the shop with him, and one contrary individual may bring apprenticeship to grief.

Therefore, it is necessary that the first apprentice in a shop, or the first two or three, be of the very highest class. They must be selected with the greatest care; they must be thoroughly questioned and examined, references must be followed up, school and employment records must be investigated and every precaption taken to make certain that the boys who are engaged will be able to carry apprenticeship through the early, precarious period.

A large choice of candidates is necessary in order to make such a careful selection effective. Complicated processes of elimination are valueless when no good material is available. Desirable young men are not easily found. Usually they are of energetic disposition and will find work of their own accord and stay at it. When business is good they must be gone after. The kind of boys who are looking for work in prosperous times is not likely to be the right kind with which to undertake the establishment of apprenticeship. Some suspicion naturally attaches to any one who is out of work when there is plenty of it. It sometimes happens that desirable young men, even in prosperous times, will look for an apprentice job for the sake of training but they will go to those plants where apprenticeship has long been an institution and not to those where it is proposed as an experiment.

Only in dull times will the manufacturer have that wide choice among young men of the highest class which he needs in order to find one or two who can carry the starting load because only in dull times are young men of the best class looking for work. For instance, should he wish to pick his first apprentices from the graduating class of a local school or high school, he will find the best men in the class eager to start in a poor year, while in a prosperous year they have arranged for satisfactory employment long before graduation. It has been frequently pointed out that apprenticeship is not alone a matter of shop management but is even more a question of public relations and community contacts. Regardless of the amount of thought and effort devoted to apprenticeship by shop officials, the movement will not be assured of complete success unless it wins the support of the people in the town or city. Parents, teachers, pastors, newspapers, Boy Scout officials, Y.M.C.A. and other social and civic groups must be won over. Apprentices must have encouragement and support not only from their superiors at work but also from the people with whom they come in contact away from work. This encouragement outside of working hours will not be available unless apprenticeship has won the confidence of the people in the community.

"Only in dull times will the manufacturer have that wide choice among young men of the highest class which he needs in order to find one or two who can carry the starting load, because only in dull times are young men of the best class looking for work."

In order to become thus convinced, the people must be made to believe in the sincerity of the apprentice plan. The public is apt to suspect the influential business man and manufacturer. People tend to ascribe ulterior and unworthy motives rather than obvious ones when the employer institutes a new activity or enterprise. In a matter that concerns the life work of their young men people not only are entitled to be but should be conservative and cautious. Should a manufacturer who has never shown any interest in apprenticeship announce a new apprentice training program in busy and prosperous times, people would merely suspect him of offering training to young men as a ruse to attract much needed help which he had failed to get by other and more direct means. They would feel that here was a fair-weather project which would be discarded with the first approach of stringency. They would hesitate to entrust boys to such an uncertain program and with justice, for such things have happened.

On the other hand, the employer who begins the training of apprentices in a period of dull business instantly secures the favor and confidence of the community. In the first place, the mere fact that he engages

young men, however few in number, when unemployment prevails, makes a favorable impression. In addition, he is given credit for instituting apprenticeship for the sake of training young men and for no other, hidden motives. It is not necessary to explain that the manufacturer who begins the training of a few apprentices, at a time when operations in his plant are much restricted, is genuinely interested in the young men and in teaching them an occupation. The most cynical skeptic could find no motive other than the desire to assist in the development of a generation of skilled mechanics and the attempt to provide some excellent opportunities for the boys of the neighborhood. Clearly, the confidence of the public, which is essential for a successful apprenticeship program, can hardly be won in prosperous times and, conversely, can hardly be missed in dull times.

These principles have been tried and proved in actual experience. In 1920 and 1921 the Falk Corporation of Milwaukee was subject to the depression which afflicted all business in those years. A few apprentices had been trained in one or two departments for many years but apprenticeship had never been a recognized and organized part of the plant administration. The directors and officers had planned for some time to build up a strong department for the training of young generations for the industry. However, they had made more than a superficial study of apprenticeship and fully appreciated that no plan of apprenticeship would be successful unless much thought and discussion were devoted to it. And because they never found the time to give the matter adequate attention the work was constantly put off. They knew that a poorly prepared apprenticeship would do more harm than good to their organization and to any apprentices they might hire.

When the depression of seven years ago arrived, the shop executives found time to consider apprenticeship properly and after conferences extending over many months, in which a great many plans were gone over and rejected, a complete system, agreeable to all, was finally adopted and approved. The advantages of selection and community favor had hardly been anticipated but became instantly evident. The apprentices in the shop were retained and a few more were engaged. The work of the boys was carefully supervised, their problems were sympathetically considered, and in those lean years there was laid the foundation for an apprentice training activity which has ever since given satisfaction to executives, to apprentices, to parents and guardians, and to all others involved.

The Sherman Act Today

Shall the Small Industrial Unit Survive?

By James Harvey Williams

THE rapid growth of consolidations and combinations of capital has challenged thoughtful consideration of the ultimate result upon small units in the industries concerned. Although public opinion on this question is unformed as yet, there is a clear indication that if they are not subjected to an early analysis, capital consolidations will go on unchecked to a point where the small unit in many industries shall have ceased to exist.

These combinations or mergers, which may be of several types, are based upon some principle, either sound economically or otherwise. The "horizontal" merger which comprises directly competing interests is formed to fix operating or sales expense-ratios or to lend stability to the sales market by removal of a disturbing competitor. Then there is the so-called "vertical" merger which seeks to acquire sources of raw material or to increase its market.

Some of these objectives have a sound economic basis in fact which "progress" cannot resist, regardless of the fate of the small industrial unit. But the great majority of these combinations are founded upon the necessity for price stabilization. To prevent the demoralization that unquestionably exists in many industries today, an effort should be made by some authoritative body to study the whole problem, to the end that future consolidations having improvement of the price structure for their major motive may be avoided by the appropriate legislation based upon a truer conception of the public welfare.

It can be readily shown by figures issued by the Bureau of Internal Revenue that national prosperity does not mean universal prosperity. For the active business year of 1925 more than 40 per cent of the net profits of the 430,000 corporations in the United States were earned by only 196 corporations. The next group of 937 corporations, each earning between $1,000,000 and $5,000,000, accounted for 25 per cent of all the corporate profits. Among the manufacturers 541 concerns acquired more than two-thirds of the profits while two out of every five showed losses.

If our so-called anti-trust legislation as embodied in the Sherman Act of 1890, and supplemented by the Clayton Act of 1914, were merely anti-trust laws, as the titles indicate and as popularly supposed, there would be small reason for the widespread criticism that has been more or less privately visited upon them by those who have been familiar with their effect upon many of the smaller business enterprises of this country. For, in so far as the Sherman Law has performed the function for which alone its creators strove, and has protected "trade and commerce against unlawful restraints and monopolies," it has been effective in preventing the growth and continuance of the grossly unfair business practices that so outraged the moral sense of the country prior to its enactment. It is only with some of the subsequent ramifications and diversions of the original purpose, which have come down through the succeeding years as the result in part of judicial interpretations and in part of the momentum lent to the popular psychology by politicians, that criticism has had to deal. But, whereas the meaning of the words "restraint of trade" has gradually and even subconsciously become subject to extended degrees of definition, nothing can be clearer than that the most flagrant "restraint of trade" conceivable then or since would have been the operation of this law in such a manner as to create the incentive, if not the necessity, for the acceleration of capital consolidation.

The public was thinking, and still is, of preventing

Abstract from the March issue, *Atlantic Monthly*.

monopoly and the concentration of capital in the hands of the few, but the politicians and the courts have been telling us in effect, until the public has come to believe it, that the way to accomplish that result is by preventing competitors from even discussing their most vital mutual problems, upon which their ability to continue to serve the public, nay, even their very existence, is often based.

Only a few years ago members of trade associations were advised not even to discuss or compare their costs, except by the use of key numbers by which each member might identify only his own report, and they were further advised to file with the Government a disclaimer of any price activity as a presumption of innocence. Any cost statistics exchanged for the information and improvement of the industry might be in the "twilight zone" unless filed with the Department of Commerce for public circulation.

Conditions to this day are practically unchanged except that in its more recent utterances on the general subject the Supreme Court has liberalized that situation somewhat by declaring:

Supreme Court Decision

Trade associations or combinations of persons or corporations which openly and fairly gather and disseminate information as to the cost of their product, the volume of production, the actual price which the products have brought in past transactions, stocks of merchandise on hand, approximate cost of transportation from the principal point of shipment to the principal points of consumption, without, however, reaching or attempting to reach any agreement or any concerted action with respect to prices or production or restraining competition, do not thereby engage in unlawful restraint of commerce.

This is some progress, to be sure, but after all, courts may only "interpret"; they may not legislate or determine fundamental policy, and therefore may not go afresh to the root of the trouble. That may be done only by Congress, enforced by public opinion.

Clearly, therefore, if substantial relief for "small business" is the real intent of public sentiment, the phrase "restraint of trade" must be redefined. As long as the theory persists that cut-throat price competition "is the life of trade," so long shall we hear the leaders in most of our industries advocating, and see them building, further combinations of capital as the only way out of the demoralizing conditions that even today infest so many important industries. In times of depression it is plain that still more of these mergers will be forced into existence.

Now, what is behind this theory of price competition to the utmost? Is it in the "public interest" that goods shall reach the consumer as cheaply as possible, regardless of whether the producer or distributor is worthy of his hire? Does the consumer alone constitute the public? Does not modern society live by exchanging the product of one individual tor that of others, and are not the interests of producer, distributor, and investor an equal part of the public interest with that of the consumer? In the last analysis, have we not each of us a dual capacity both as earner and as spender, and can society spend without earning or live without spending? Surely it should be self-evident that where a whole industry operates with little or no profit, as is frequently the case today, the purchasing power of both labor and investor is either diminished or threatened and that a continuance of that condition means either loss of capital or combination. Stabilized prices mean stabilized wages; the two together mean stabilized purchasing power, which exercises an all-important influence upon the stabilization of business activity.

Co-operation Necessary

Price-fixing, that supposed synonym for opprobrium, where it could be applied at all, would operate chiefly to prevent demoralization when supply exceeded demand. It is, of course, here that its public benefit would accrue. Admittedly in many industries it would not be feasible in any case, because of the varying character, design, and requirements of the product or the multiplicity of the sources of supply. But it is not price-fixing alone that is the crying need of so many industries today so much as the privilege of complete co-operation for the stabilization of a moderate prosperity to capital efficiently conducted and labor efficiently performed; education in such matters as what constitutes a fair profit, based on such factors as the proportion of investment required, the frequency of capital turnover possible, and the degree of risk involved. Upon such vital subjects competitors may not lawfully take counsel with each other.

Redress for the present situation could be obtained if instead of the present definitions of the Sherman and Clayton Acts which prohibit agreements or combinations "in restraint of trade," these acts were to be amended to consider such agreements or combinations unlawful when they are "to the detriment of the public" or carry with them "intent to destroy or injure, by means of unfair competition any industry the preservation of which is to the advantage of the country, having due regard to the interests of the producers, workers and consumers." What simplicity of enforcement and of fact-finding underlies the economic objective of this Australian Industries Preservation Act as quoted. What a boon its adoption in this country would be, properly and strictly enforced!

How Does the Gear Pump Function?

Lubrication of all kinds of industrial machine equipment is finally getting the careful attention it has so long merited. One phase of it is flood or cascade oiling, the oil being supplied by some type of pump. Perhaps the simplest type of pump for this purpose is the one consisting of a pair of gears in a tight casing. How it functions and how it should be designed are described in the next issue by Professor Buckingham.

Measurement of the Thickness of Involute Gear Teeth

By Allan H. Candee
Gleason Works, Rochester, N. Y.

Development of the formulas for measuring the thickness of helical gear teeth by the standard pin method and their application to a typical case

HELICAL gear teeth can also be measured by the pin method. In the case of an odd number of teeth a certain advantage is lost because the two pins cannot be placed symmetrically opposite each other and due to the effect of their oblique position the dimension over them cannot be conveniently obtained with ordinary micrometers. Three pins might be used in the manner of the three-wire method of measuring screw threads, but it is more convenient to use one pin and measure across the opposite tooth. Obviously, in this case the outside diameter of the teeth must be accurately determined. The determination of the distance across pins for helical involute gears is a somewhat puzzling problem and the writer has never seen a solution in print. Formulas quite analogous to those for spur gears can be derived, however, by making use of a certain unique property of helical involute surfaces, namely that all normals to a given helical involute surface make the same constant angle with a plane of rotation perpendicular to the axis. In order to understand the geometry of helical involute teeth involved in the present problem, it is necessary to have clearly in mind the definitions of certain planes and angles. The first five of the definitions given below apply to both spur gears and helical gears.

1. Plane of rotation, perpendicular to axis of gear
2. Pitch plane, tangent to pitch cylinder
3. Axial plane, containing axis and being perpendicular to pitch plane at tangent point.
4. Plane of action, containing involute line of action in plane of rotation, and being tangent to base cylinder
5. Pressure angle α, measured in plane of rotation between line of action and the line of intersection with pitch plane.

The following additional definitions apply to helical involute gears:

6. Normal plane, normal to helical tooth in pitch plane and perpendicular to pitch plane, that is, normal to pitch helix.
7. Helix angle h, measured in pitch plane between lines of intersection of normal plane and plane of rotation with pitch plane
8. Base helix angle H, measured in plane of action between lines of intersection of normal plane and plane of rotation with plane of action
9. Normal pressure angle α_n, measured in normal plane between lines of intersection of plane of action and pitch plane with normal plane.

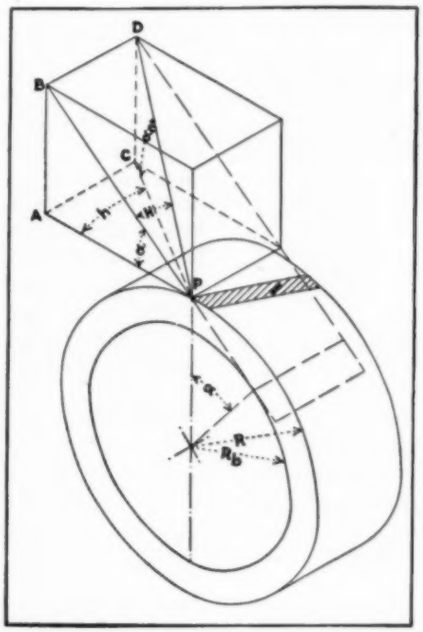


Fig. 8—Establishment of angles and planes in relation to a helical involute tooth surface

In Fig. 8, P is a point in the surface of a helical involute tooth and also in the surface of the pitch cylinder of radius R. The plane of rotation through P and the pitch plane intersect in the pitch line AP. In the plane of rotation the involute line of action BP is normal to the tooth profile (not shown) and tangent to the base cylinder of radius R_b. The plane of action contains BP and is tangent to the base cylinder. In the pitch plane, CP is normal to the helical tooth, and is the intersection of the pitch plane with the normal plane, which also intersects the plane of action in DP. This line DP, being in the plane of action, is normal to the involute profile of the tooth; and being in the normal plane, DP is also normal to the pitch helix of the tooth. Therefore, DP is normal to two curves in the tooth surface and, according to the principles of solid geometry, is normal to the surface. For the purposes of calculation the diagram has been constructed with points A, B, C, and D all in a plane parallel to the axial plane, so that angles BAP, BAC, DCP, and DBP are right angles. Then, according to the definitions previously given

Pressure angle α = angle BPA
Normal pressure angle α_n = angle DPC
Helix angle h = angle CPA
Base helix angle H = angle DPB

Of course, as is well known and as can readily be seen in the diagram

$$\tan \alpha_n = \tan \alpha \cos h$$

It will now be shown that angle H between the normal DP to the tooth surface and the plane of rotation,

The third and last article of the series.

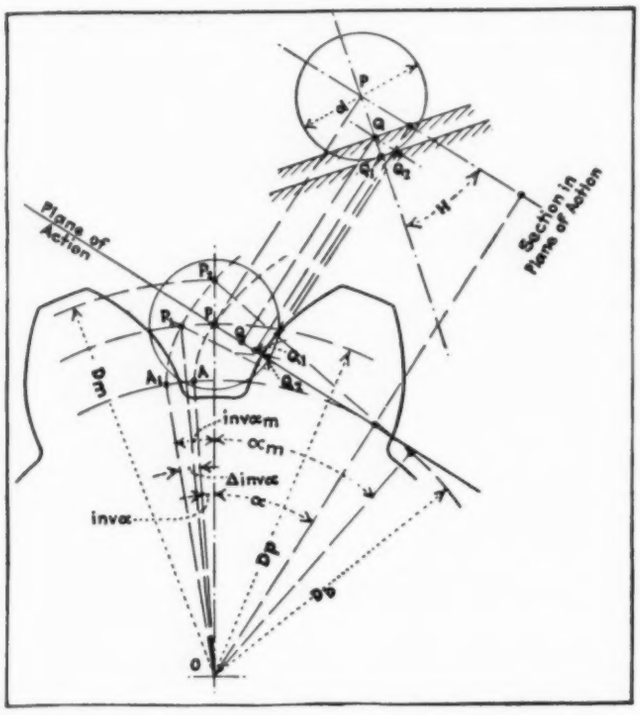


Fig. 9—Equivalent case of a ball substituted for a pin in measuring helical involute gear teeth

has a constant value irrespective of the radius K at which the point P may be taken.

In triangle BPA, $\quad BP = \dfrac{AP}{\cos\alpha}$

In triangle CPA, $\quad CA = AP \tan h$

In rectangle $BDCA$, $\quad DB = CA = AP \tan h$

In triangle DPB, $\tan H = \dfrac{DB}{BP} = \dfrac{AP \tan h}{\dfrac{AP}{\cos\alpha}}$

so that $$\tan H = \tan h \cos\alpha \qquad (7)$$

By construction α = pressure angle

and h = helix angle

when R = pitch radius

and R_b = base radius, which is a fixed dimension for any spur or helical involute gear.

Let L = lead of helical teeth, also a constant dimension at all radii.

But $$\cos\alpha = \frac{R_b}{R} \text{ always}$$

and $$\tan h = \frac{2\pi R}{L}$$

Substituting these values in equation 7, we have

$$\tan H = \frac{2\pi R}{L} \times \frac{R_b}{R}$$

or $$\tan H = \frac{2\pi R_b}{L} \qquad (8)$$

Since in this equation R_b and L are constants, tan H and H are also constants. Equation 8 also shows that H is the helix angle of the tooth on the base cylinder of radius R_b of the gear.

It is thus demonstrated that the normal at any point in a helical involute surface makes a constant angle with a plane of rotation and that this angle is the base helix angle. Usually the most convenient way to determine the value of the angle is by means of equation 7, because of its simplicity.

When the surface of the measuring pin is in contact with the tooth surface, the pin radius to the point of contact is, of course, normal to both surfaces. In the position for measuring, the pin is subjected to the action of three forces, namely, pressure at the points of contact with the two sides of the tooth space and with the micrometer. Equilibrium of these three forces and a stable position are obtained only when the direction lines of the forces intersect at a common point. This means that the three pin-radii to the points of contact must have the same center on the pin axis, the position being one of complete symmetry. It then simplifies matters considerably to consider that the pin is replaced by an equivalent sphere of the same diameter.

In Fig. 9, the lower diagram shows projections of points and lines to a plane of rotation, and the upper diagram shows corresponding positions in the plane of action. The central point of the tooth space on the pitch cylinder is P. The tooth normal through P intersects the tooth surface at Q. The sphere of diameter d, equivalent to the measuring pin, with center at P is intersected by the tooth normal at Q_1.

Letting S_n be the normal width of the tooth space measured on the normal pitch helix, the true distance from P to Q is

$$PQ = \tfrac{1}{2} S_n \cos\alpha_n$$

Then since $$PQ_1 = \tfrac{1}{2} d$$

the true distance from Q to Q_1 on the tooth normal is

$$QQ_1 = \tfrac{1}{2} (d - S_n \cos\alpha_n)$$

The sections of helical involute surfaces through Q and Q_1 respectively are indicated in the upper diagram. The point Q_2 is in the surface through Q_1 and in the same plane of rotation as Q. Therefore, in order to bring the sphere into a position of tangency with the helical tooth surface containing Q, it is necessary to rotate it about the gear axis through some angle POP_1 sufficient to move Q_2 to Q. Then the position of the sphere or pin when measuring the tooth thickness, is finally determined by rolling outward on the involute profile until the center reaches P_2 on the radius OP.

Evidently $$QQ_2 = \frac{QQ_1}{\cos H} = \tfrac{1}{2} \frac{(d - S_n \cos\alpha_n)}{\cos H}$$

and $$\text{angle } POP_1 = \frac{QQ_2}{R_b} = \frac{(d - S_n \cos\alpha_n)}{D_p \cos\alpha \cos H}$$

But $$\text{angle } AOA_1 = \text{angle } POP_1$$

so that $$\Delta \text{inv}\alpha = \frac{(d - S_n \cos\alpha_n)}{D_p \cos\alpha \cos H} \qquad (9)$$

To simplify this expression let the normal diametral pitch

$$P_n = \frac{P}{\cos h}$$

Then, since $$D_p = \frac{N}{P}$$

also $$D_p = \frac{N \cos h}{P_n}$$

Substituting this value in equation 9 and rearranging slightly, we obtain

$$CP = DP \cos\alpha_n$$

$$\Delta \text{inv}\alpha = \frac{P_n}{N} \left(\frac{d}{\cos\alpha_n - S_n} - S_n \right) \frac{\cos\alpha_n \cos h}{\cos\alpha \cos H} \qquad (9a)$$

But it can be seen in Fig. 8 that

$$CP = DP \cos\alpha_n$$

and $$AP = CP \cos h = DP \cos\alpha_n \cos h$$

Also $$BP = DP \cos H$$

and $$AP = BP \cos\alpha = DP \cos\alpha \cos H$$

Equating these two values for AP it follows that

$$\cos\alpha_n \cos h = \cos\alpha \cos H$$

Therefore equation 9a becomes

$$\Delta \text{inv}\alpha = \frac{P_n}{N}\left(\frac{d}{\cos\alpha_n} - S_n\right) \qquad (10)$$

Attention is here called to the very interesting similarity of this equation 10 for helical gears to the corresponding equation for spur gears. Thus, by substituting for D_p in equation 4 we have for spur gears

$$\Delta \text{inv}\alpha = \frac{P}{N}\left(\frac{d}{\cos\alpha} - S\right) \qquad (11)$$

The remaining steps in the calculations of the dimension across the measuring pins is the same for helical gears as for spur gears. This procedure will be illustrated by a numerical example. Let the normal tooth dimensions, as well as the number of teeth, be the same as for the spur gear for which calculations were previously given, that is:

Number of teeth	$N = 31$
Normal diametral pitch	$P_n = 8$
Normal pressure angle	$\alpha_n = 20°$
Normal tooth thickness	$T_n = 0.194$ in.
Pin diameter	$d = 0.210$ in.

Then, with an assumed pitch helix angle of 30 deg., the calculations are as follows:

Helix angle	h	$30°$	
	$\cos h$	0.8660	
	$\tan\alpha_n$	0.3640	
	$\tan\alpha = \frac{\tan\alpha_n}{\cos h}$	0.4203	
Pressure angle	α	$22°48'$	
Normal circular pitch	$P_n = 3.1416 \div P_n$	0.3927	in.
	$\cos\alpha_n$	0.1987	in.
Normal width of space	$S_n = P_n - T_n$	0.9397	
	$\frac{d}{\cos\alpha_n}$	0.2235	
	$\frac{d}{\cos\alpha_n - S_n}$	0.0248	
	$D_n = \frac{N}{P_n}$	3.875	in.
[see equation 11]	$\Delta \text{inv}\alpha = \frac{\left(\frac{d}{\cos\alpha_n} - S_n\right)}{D_n}$	0.00640	
[Table I]	$\text{inv}\alpha$	0.02242	
	$\text{inv}\alpha_m = \text{inv}\alpha + \Delta \text{inv}\alpha$	0.02882	
[Table I]	$\sec\alpha_m$	1.10062	
[Table I]	$\sec\alpha$	1.08475	
	$\Delta\sec\alpha = \sec\alpha_m - \sec\alpha$	0.01587	
	$D_p = \frac{D_n}{\cos h}$	4.475	in.
	$\Delta_m D = \left(\frac{\sec\alpha}{\Delta\sec\alpha}\right) D_p$	0.066	in.
Diameter across pin centers for even number of teeth	$D_m = D_p + \Delta_m D$	4.541	in.
	d	0.210	in.
Diameter over pins for even number of teeth	$D_m = D_m + d$	4.751	in.
Outside diameter of gear	D_o (known)	4.675	in.
	$D_m + D_o$	9.426	in.
Dimension over pin and opposite tooth	$D_{mo} = \frac{1}{2}(D_m + D_o)$	4.713	in.

The thickness factor k for estimating small changes in D_m and T_n, in the case of helical gears would be exactly $k = \tan\alpha_n \cos h_m$

where h_m is the helix angle on the measuring diameter D_m. However, the difference between cos h and cos h_m is so small that the approximate value may be used.

$$k = \tan\alpha_m \cos h$$

It will be noted in comparing values in the preceding calculations for spur and for helical gears, that the value for $\Delta \text{inv}\alpha$ was the same for both, and that the values for the differences between the pitch diameters and the diameters to pin centers (assuming even number of teeth) were almost equal, namely,

for spur gear $\Delta_m D = 0.064$ in.
for helical gear $\Delta_m D = 0.066$ in.

It is natural to ask, therefore, whether or not a short way can be found to calculate the extremely small difference between these two values. A mathematical analysis too long to be given here has led to a somewhat empirical formula which gives fairly close results. Let the difference $D_m - D_p = \Delta_m D_s$ for spur gears and $\Delta_m D_h$ for helical gears. And let

$$\Delta_h D = \Delta_m D_h - \Delta_m D_s$$

Then the approximate formula which has been derived is

$$\Delta_h D = 0.105\left(\frac{\frac{d}{\cos\alpha_n} - S_n}{\sin\alpha_n \tan\alpha_n}\right)^2 \left(\frac{1 - \cos^3 h}{N^{0.7}}\right) \qquad (12)$$

This rather complicated appearing expression becomes considerably simplified by the substitution of standard numerical values, thus:

1 D.P. $\quad d = 1.680$ in. $\quad S_n = 1.5708$ in.

for $\alpha_n = 14\frac{1}{2}°$ $\quad \Delta_h D = 0.68\,(1 - \cos^3 h) N^{0.7}$ (13)

for $\alpha_n = 20°$ $\quad \Delta_h D = 0.32\,(1 - \cos^3 h) N^{0.7}$ (14)

Applying equation 14 to the helical gear for which calculations have been given, and remembering that the teeth were 8 *D.P.*, we have

$$\Delta_h D = \frac{0.32\,(1 - \cos^3 30°)}{8 \times 31^{0.7}} = 0.00126 \text{ in.}$$

In the preceding calculations, results were given only to the third decimal place, and this difference appears as 0.002 inch.

The following table shows how near some other results obtained by these formulas come to correct values. The figures under $\Delta_h D_1$ were obtained by exact calculation, those under $\Delta_h D_2$, by means of the above formulas.

n Deg.	N	$\Delta_m D_s$ In.	h Deg.	$\Delta_m D_h$ In.	$\Delta_h D_1$ In.	$\Delta_h D_2$ In.
$14\frac{1}{2}$	20	0.541	15	0.547	0.006	0.008
$14\frac{1}{2}$	20	0.541	45	0.593	0.052	0.054
$14\frac{1}{2}$	80	0.603	45	0.623	0.020	0.021
20	20	0.545	45	0.575	0.030	0.026
20	80	0.581	45	0.590	0.009	0.010

The greatest difference shown here is 0.004 in. This would mean an error of 0.004 in. in dimension over pins (D_m) for 1 *DP*, and an error of only about 0.0014 in. in tooth thickness, which would not be at all serious. However, it requires almost as much work to start with the standard tables for spur gears and use these approximate formulas to make the change to helical teeth, as to carry through the direct helical calculations in the way illustrated in the numerical example given above. Therefore, these final formulas have been included more for the purpose of making the information presented here as complete as possible, than for actual application.

Manufacturers of helical and herringbone gears of standard helix angle and pressure angle, would obtain the same advantages of convenience and increased accuracy of measurement by the compilation and use of standard tables for helical teeth, as have actually resulted from the use of the tables for spur gears that were published in the preceding article. The pin method of measurement is also useful in checking the accuracy of other forms of teeth, such as ratchet teeth, although such cases require different calculations without reference to the geometry of the involute curve which has been given in considerable detail in the first article of this series.

Before closing, just a word of warning should be given about the importance of correct tooth form. The system of tooth thickness measurement that has been described is necessarily based upon the assumption that the tooth profiles are reasonably close to the true involute shape and that the pressure angles are accurately known. Since the measuring pins do not contact with the tooth profiles at the pitch circle, departure from involute shape will introduce corresponding errors in the results. In this case, the difference or error will increase as the pin contact gets farther and farther away from the pitch circle. With teeth of standard proportions there is little chance of trouble, but the possibility of inaccurate profiles or pressure angles should be kept in mind in the special cases of thick and thin teeth, long and short addenda, and other errors in manufacture.

Increasing Use of Alternating Current a Factor in Improved Machine Tools

By R. N. Piper
The Cincinnati Bickford Tool Company

IN THE days when nearly all industrial plants generated their own power, direct current was used almost universally. Recent years, however, have witnessed the rise of great central station plants, distributing power over wide areas. Due to the greater economies in the generation and transmission of alternating current, as compared with direct current, the entire output of these plants is alternating current.

The large scale on which these central station plants operate usually enables them to supply the metal manufacturer with power at a lower cost than he can produce it in his own plant. As a result, each year sees a greater number of privately owned direct-current power plants abandoned because of cheap alternating current available from the large central stations.

Nor do the economies end with the purchase of current. Additional savings are realized because a.c. constant-speed motors can be purchased at approximately one-half the price of variable-speed d.c. motors. Then, too, there is the cost of maintenance. Obviously there is no comparison in maintenance costs between the simple a.c. motor and the d.c. motor with its commutator and brushes. In view of these economies it is not surprising that a.c. motor installations are outnumbering the d.c. motor installations at a rapidly increasing rate.

This rapid changing over from direct current to alternating current has had a large influence on machine tool design. Machine tools have been developed for constant-speed a.c. motor drive that have all the flexibility of those driven by variable-speed motors. Gear trains have been worked out that give more speed changes over a wider range and with less gears than ever before. Heat treated alloy steel gears and heat treated alloy steel shafts mounted on antifriction bearings and automatically oiled have replaced machine steel gears, cold rolled shafts and other unreliable and old fashioned units.

A decade or more ago, when tumbler gear boxes, cast iron gears, scattered controls and "hit or miss" oiling were in vogue, the buyer of general purpose machine tools was justified in considering a variable speed motor drive as the lesser of two evils. Rapid strides in machine tool design in recent years have made unnecessary the burden of greater cost of direct current, increased cost of maintenance on electrical equipment and the inefficiency of fluctuating motor speeds.

Proper consideration of the resale value of equipment has given impetus to the movement toward constant speed drives. The market for equipment which can be used in any shop is obviously much greater than for tools which can be used only with a direct current variable speed motor.

This tendency away from variable speed motor drives is reflected in the newest products of progressive machine tool builders; for the variable speed motor, even when used with back gears, does not provide a sufficient range of speeds for many purposes. Economy is sacrificed if the variation in motor speed is more than 3 to 1 and a variation of more than 6 to 1 is rarely attempted.

In the modern machine tool, convenience and flexibility are obtained by new methods of securing many changes of speed and feed. Hardened alloy steel gears sliding on multiple-splined, integral-keyed shafts have superseded the old fashioned cast iron tumbler gearing. Automatic filtered oiling and roller bearing construction make this arrangement efficient, durable and trouble proof.

The constant-speed motor has made possible the constant-speed power rapid traverse. This has become a familiar feature on milling machines, planers and radial drills and is becoming a standard on other machines.

The lower cost of alternating current and lower cost of maintenance on a.c. equipment, and the increasing demand for more flexible and easily controlled machines have brought about remarkable improvements in machine tool design. These improvements no longer make it necessary to use antiquated methods of speed control through costly and inefficient drives.

· THE · FOREMAN'S · ROUND · TABLE ·

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

Helping Tony Celebrate

"WHY the bouquet, Al? Going to see a new girl, or something?"

"Something, Ed—but not a new girl. Just helping the Italian boys in my department celebrate."

"Since when did you change nationalities? Keeps me busy celebrating all our own holidays. How do you get that way, Al?"

"More or less of an experiment, Ed. Got to talking with Tony Moretti the other noon about the shop he worked in back in sunny Italy. Told me a lot of interesting things about the shop, and then branched off on the holiday they would be celebrating soon—comes today, in fact.

"Tony told me how much it meant to them over there, and wanted to know if I minded if he and the others of his countrymen wore this kind of flower today. Of course I told him to have them all wear it. Then I had a sort of inspiration, Ed. Told him I'd be glad to wear one myself, and help him celebrate. And was he tickled? I'll say he was. So that's how, Ed."

"Don't appeal to me at all, Al. They ought to forget all that stuff when they come here."

"Piffle, Ed. You had cold pancakes for breakfast. Would you forget the Fourth of July just because you happened to go to Italy to live? Of course you wouldn't—and you'd be as tickled as Tony to have the boss help you celebrate."

"Don't get you anywhere, Al."

"Get's me the friendly feeling of every Italian in the shop, Ed, unless I kill it by being unfair some other way. Let's them know we're human, if we are foremen, and makes them more willing to help out in a pinch."

"It isn't part of the foreman's job, Al, not unless it helps to get out work, and at a lower cost."

"Now I know you've got dyspepsia or something like it, Ed. Of course it's a foreman's job to get out production at low cost. And if wearing blue lilies or red geraniums makes the men feel like helping him, then it's good business. If I thought it would help production to put a few canaries or parrots in the shop, I'd ask Williams to get 'em."

Was it good policy for Al to help his men celebrate? Or should he frown on such displays? How far can a foreman go in this direction?

All foremen are urged to discuss these questions vital to their work; of course the

discussion is not limited to foremen. Letters accepted and published will be paid for

Discussion of Earlier Topics

Extra Pay for Extra Effort

THOSE financially interested in business have much to contend with. There is always the risk, the element of uncertainty and the executive initiative which must be accounted for. They have, consequently, a right to expect a reasonable return on their investment in the form of profit.

When engineers are employed to reduce the cost of process and product design the operator is, in reality, receiving part of the benefit in the form of steady employment. In the case cited the tables are turned, however, and the operator finds a method of increasing production. He should be satisfied with a bonus for his initiative and a lowered piece rate. This lowered piece rate coupled with the increased production, enables the operator to earn more than ever before, and allows the firm an additional margin between the cost of production and the selling price. —CHARLES E. LANE.

IN ORDER to stimulate general interest among the employees so that they will devise ways and means to increase production, it is deemed highly desirable in the modern shop to create a committee to pass on all suggestions made by the employees. This committee should not only have the authority to accept suggestions, but should also have the privilege of establishing a just bonus that can be awarded to the person responsible.
—W. M. JAHN.

Al and Williams were quite right in deciding that no extra remuneration was necessary, provided that the piece rate was not cut, when the man by his own efforts increased his production from 50 to 70 units per hour.

If it was necessary to cut the rate to keep it in line with other jobs, then decidedly the man should be given a substantial bonus, provided that the short cut which the man devised did not incur any undue expense for provision or upkeep of tools. It would be extremely unfair to cut the rate and give no bonus. The worker would be perfectly justified in feeling sore. Both he and his fellow workmen would lose all incentive to further effort of either hand or brain. In the end the firm would be the loser. —JOHN T. TAYLOR.

IF AN operator conceives of a new arrangement that reduces the unit time for a job, two things must be done. First, since the benefit derived by the employer through this new set-up is directly traceable to the ingenuity of the operator, the latter should be allowed to benefit substantially thereby. He should receive a bonus based upon the savings effected by the new conditions. The reward should consist of a certain portion of the annual saving over a single year's business. Second, it is necessary to place a new rate upon the operation to conform to the new conditions.
—D. C. WRIGHT.

IF THE piece rate is not decreased, the worker naturally has a better attitude toward his employers and will take more interest in seeing to it that other jobs beside his own go smoothly through the department where he works. If the working conditions are improved, the workmen in general will show a tendency to produce a better article; hence there will be fewer rejections from the inspection department. Furthermore, when the workman is allowed to increase his income he will talk encouragingly to his workmates and this will cause an improvement in shop morale.

A bonus is not at all necessary in the writer's belief. If, however, a certain number of separate units are required by a certain date, and a bonus is offered the other workmen, the other workmen and our particular workman should all share in it, —F. H. STEBBINS.

Shall It Be Layoffs or Short Time?

WHEN business slumps, our first course is to build up to maximum figures our inventories of finished material and work in process. As dullness continues beyond the point where it can be counteracted in this manner, we gradually cut the number of working days, aiding the situation as much as possible by dropping very recent or undesirable employees. When current business will not support three full working days a week, we start suspensions, leaving the ranks of those with ten years or more service untouched, and selecting those to go with a thought for their home responsibilities, their abilities as workmen, and their seniority.

We do not put the question to the men because we believe the management, through the production man-

THE · NEXT · TOPIC

Getting the Wear Out of Machines

ADVANCE QUESTION

Ed is afraid high speeds will wear out machines too fast. Al thinks it pays to wear them out, if you get the work out of them. Who is right?

ager and the foremen, is much more capable of seeing all sides of the picture and determining an impartial, human and business-like policy.

—W. C. LANDIS, *Superintendent.*

THE method of retrenching during a dull period should be decided by the company. It is true that the employees like to have something to say about what is to happen, yet it is not the best policy. Man is selfish and without a doubt the large majority would vote in such a manner as to benefit the individual. If the company should desire to make any change in the personnel of the plant, the logical time to do so is during a slack spell. If the employees decide the method of retrenching, the management may be handicapped in doing as it wishes in regard to any contemplated changes.

—P. H. PEARSON.

Should the Super Talk to the Men?

THAT WILLIAMS took an interest in and talked to some of the best men in the shop is nothing for a foreman to be alarmed at. In a certain firm in England employing over 1,000 men, the boss made a practice of being in his office for a quarter of an hour after finishing time. Any employee wishing to see him, either with a grievance or to ask his personal advice, could do so. This plan was kept up for fifty years, and during that time the results were excellent. The management did not have one serious dispute with the workers which involved a strike. Many of the men have been there for a lifetime, and give their best in appreciation of the firm's consideration.

Williams is probably visiting the men to encourage them. If he is not satisfied with Ed's work, he could get information about him without openly visiting the shop men. It would be to the advantage of a good foreman to have Williams visit the shop and find all the men contented. Of course, for an indifferent foreman the results might be unpleasant.

—W. E. WARNER, *England.*

IT IS necessary that the super place himself more or less in contact with the men. Among other things, he will appreciate better the reasons why things are done as they are, and he may discover a way of doing them better. Moreover, it will have an effect on the morale, which in certain circumstances is of great importance.

Above all things, however, the super should not give orders to the men, but to the foreman. The contact should not be too frequent nor too familiar, or the supe·'s prestige and the discipline will suffer. If a foreman should quit suddenly, how would the super know who should replace him in the work if he did not know his men?

—G. DESCOTTE, *Belgium.*

Paying a Bonus to Outsiders

THE outsider who thinks of a way to cut down the work of the regular operator certainly deserves some kind of a reward. Rather than attempt to figure the bonus as a percentage of the saving involved, however, I would fix a nominal sum as a reward for all practical ideas. If necessary, I would have this roughly classified into two or three groups, depending upon the importance. As the operator, as long as I did not suffer financially, I believe that I would swallow my pride and vow to get the jump on the better idea next time. If it resulted in a reduced piece rate which made it possible for me to make as much or more money than under the old system, I'd be human enough to be sore about it.

—WALTER E. ROTH.

I BELIEVE that recognition should always be given for any suggestion regardless of its source, which is accepted and proves to be an improvement of value to the employer. This can be done in many ways, but in the majority of cases is most satisfactory by giving a bonus using the net savings effected as the basis upon which the amount is figured.

In introducing a method that comes from an outside source nothing should be done that would make those who are working on the job feel belittled. Every workman should be made to realize that the value of a suggestion depends entirely upon its practical application rather than on its source.

—JOHN MARK MAY.

IT IS my opinion that any worker who has been instrumental in improving the method of performing a job is entitled to some kind of a reward, regardless of whether he is directly or indirectly connected with the job. The reward may be in the form of either a bonus figured on the basis of a percentage of the saving realized from the improved method, or a single sum of money depending upon the importance of the improvement. In the latter case, a suggestion committee, made up of men familiar with the company's equipment and line of production, could vote on the sum to be paid. This plan, at the present time, is used in many of the largest plants.

—J. WAITKUS.

Is the Kicker Always a Nuisance?

ABSOLUTELY not! It is quite possible that the so-called "kicker" may be a help instead of a nuisance. Some men are apt to get over-anxious, in trying to help the management, by calling the attention of the foreman to different things such as the holes in the shop floor, and if they carry it too far they are apt to become something of a nuisance, and be branded as a kicker. However, if the foreman will use a little discretion with these men in seeing that they do not go too far, much good may result. On the other hand, if the foreman should sit on the kicker, so as to speak, he may lose very valuable suggestions, not only from the kicker, but also from the other men as well. I think the foreman should get behind the kickers and try to make "boosters" of them.

—F. E. CLARKE.

He Never Asks for a Raise

MANY a good man loses out in his opportunities because he has never realized that the initial responsibility of asking for a raise is his own. The man who calmly passes the buck up to the boss, shirking all personal responsibility and interest, is lacking in backbone, particularly if the only action he will take is to quit when he thinks he has waited long enough.

The proper thing to do is to size up the job with the money paid, in a logical way, and present the argument for a raise with facts to substantiate the request. When the state of mind is reached where a raise seems reasonable, it is better to present the case than to await developments with an unexpressed mental reservation

that if it isn't forthcoming in a certain time the thing to do is to quit. Even if the raise cannot be given, it affords the supervisor a chance to explain why it can't be made, which may be based on facts entirely beyond his control. If the job is question doesn't rate more money the man can be kept in mind for transfer to one that does when the opportunity affords.

—F. J. SCHIMPF.

Discovering Hidden Ability in the Men

WHEN I find a careless man in the shop, I see that he is put on the safety committee. Usually, he takes a very active interest in safety matters and discards his careless habits. Eventually his interest is aroused to the point that he makes suggestions for improved production.

Like the careless man, the "crab" is a person who has never been given responsibility. Perhaps that is the reason for his ill temper. In his case, also, a little careful treatment will cause him to become of more value to the shop and to be more respected. —J. H. FEEDLER.

Co-operating on Theory and Practice

AL HAS the right idea about this theory and practice stuff. In years past there existed something of an idea of rivalry between the theoretical and the practical, between the learning from books, and the learning by hard knocks, between the "white shirt" machinist and the practical man. This idea, if it still exists at all, is very rapidly disappearing. Scientists have accomplished wonders, and we are all reaping the benefits, and if any man is really practical he will have to admit this. Therefore the least he can do with a student of theory is to co-operate in every way possible, with an idea of assisting in future developments. Surely a good place to try this is in a machine shop. —F. E. CLARKE.

They Set Their Own Rates

TIME fixing on piece-work jobs should certainly be arranged in co-operation with the operator. The average mechanic is usually honest enough to give a fair estimate of the percentage usually allowed for the "machine delays" that are factors of time studies. The operator's estimate in this connection is not only necessary but invaluable if he is to be expected to take the interest in the job that leads to big production.

—A. E. GREGORY, *England.*

Too Many Safety Signs

I CAN'T help but agree with Williams that this matter of safety signs is often overdone. Take a swimming pool for example, they usually tell you the depth of water at each end and that's all. It's not all plastered up with signs about "Don't Dive in the Shallow End"—"Look Where You Are Diving"—"Don't Forget to Come Up For Air." Yet some of the shop safety signs are even more ridiculous than these. In the swimming pool, if you can't swim you are expected to place yourself in the hands of the instructor provided for that purpose, not to jump overboard and start reading signs to find that you shouldn't have done it. Just as the man who can swim just swims, so the man in the shop, who knows how it should be done, does it. For the embryo mechanic, the foreman or his assistant takes the place of the swimming instructor in telling him how to do it correctly.

A few well chosen signs may not be exactly amiss in the shop, but just because they are free is not a sufficient reason for making a collection of them. Many a function that is performed perfectly though automatically, becomes a dangerous procedure when the mechanic consciously tries to avoid the recently revealed dangers of the safety sign. —J. D. DYER.

THE percentage of accidents in a plant will generally be commensurate with the amount of interest and energy shown by the executive staff in putting a safety campaign across successfully.

This does not necessarily mean that as many safety signs as it is possible to get on display at one time should be used. This would tend to make the employees feel that their lives were always in constant danger or, on the other hand, make them feel that they were "fed up" with safety and willing to take a chance.

The true safety worker is not the employee who goes around in a nervous state worrying lest he meet with an accident but rather the employee who has learned where the dangers really are and is happy and content because he knows what to do to avoid them.

Safety signs should be displayed at all places where a hazard really exists and employees should be taught how to avoid these hazards. Safety posters should also be displayed regularly on the bulletin boards or at other conspicuous places to keep up the interest. These posters should be selected so that they will have some bearing on accidents that might possibly happen in the shop where they are displayed, and should be such that they drive home a definite safety message to the reader.

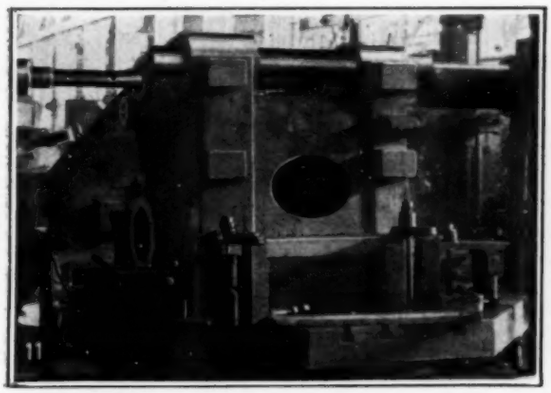
Displaying safety charts showing the amount of accidents in each department and encouraging departments to compete with each other for a perfect record are also great helps. —C. L. ANDERSON.

TOO much of anything may be a nuisance. Any method of preventing accidents that has been proven by a reasonable number of instances and which is applied with discretion, will certainly produce good results. The fact that one shop operated safely with no signs for three months is no reason why Williams should have done the same. He was acting unwisely in assuming that he would get the same results merely on the strength of one experiment. If he had known of numerous successful cases over a period of several years, he would have been justified in his action. Safety in the shop is a serious matter, and diversions from prescribed and proven methods are dangerous. —PAUL F. FRICK.

Paternalism or Privacy?

THE average man likes to be independent. If anyone tries to pry into his private affairs he resents it, whether it be the company he works for or any other individual. Give him a good place to work in, and reasonable wages, and he will be satisfied. If the company desires to give certain kinds of service, all well and good, but there should be no semblance of coercion in offering it. Let the employee seek the service himself.

Some kinds of service, especially any financing proposition, requires an investigation into the financial condition of the employee, but even this leaves a bad taste. A man cannot help feeling that it is nobody's business what it costs him to live, or how much money he has in the bank. —P. H. PEARSON.



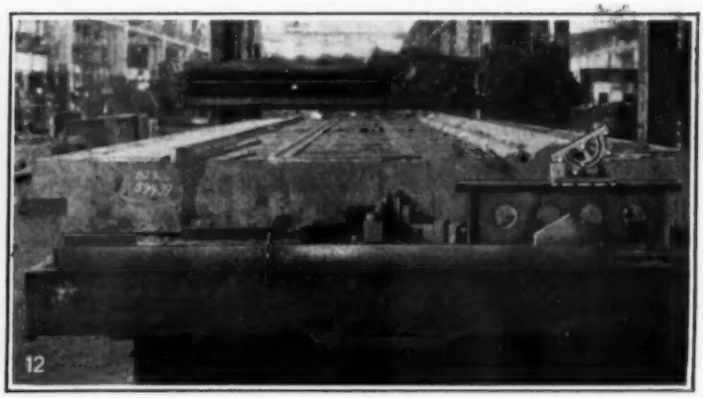


Fig. 11—Boring gear-shaft holes in the head of a driving-wheel lathe. Fig. 12—Planing the guiding V on the planer table

Accuracy in Large Machine Tools

By H. K. Smyth and W. C. Wais

IN FITTING spindle bearings of engine lathes, car wheel and driving-wheel lathes, large milling machines, and the like, special mandrels have been prepared for each size and type of machine. After the boring operation, the headstock of an engine lathe, for example, is brought to the fitter's floor, where bronze bushings are fitted front and back, and the spindle bearings are scraped to a mandrel that is accurately ground to a standard size. This operation brings the front and back bearings in line with each other, as well as insures the hole being a standard size. The spindle, which has been ground with the proper running allowances, can now be put in place. This method insures complete interchangeability and replacement at a later date. The old method of fitting each individual spindle to its own headstock has been entirely discarded for the interchangeable method just described. The advantages of this method will be seen in the case of such machines as wheel lathes, which have two opposing headstocks and in which the spindles must be kept in accurate alignment. After the master mandrels have been fitted the headstocks are brought back to the planer for the finishing operations on the surfaces that bear on the bed. They are then finish planed in pairs, the master mandrel being used in the spindle bearings to aid in securing proper alignment. The ends of the mandrel are both ground to the same diameter, and these ends rest in accurate V-blocks.

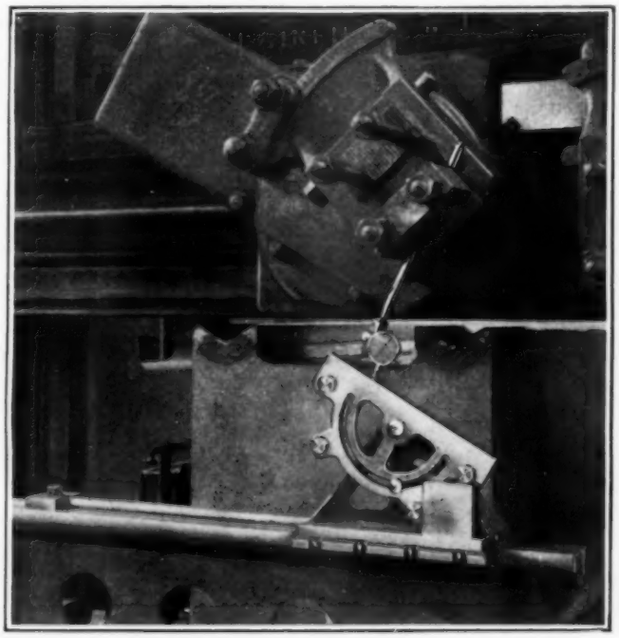


Fig. 13—A close view showing how the toolhead is set to the correct angle. The gage is set to a predetermined angle by bringing one of the buttons into contact with a gage block. The dial indicator is used to test the setting of the toolhead

With the headstocks properly aligned in this way, a finishing cut is taken over the bottom surfaces. The headstock of a wheel lathe is shown on the table of a horizontal boring machine in Fig. 11. The master mandrel is in position in the upper bearing, and is also used for accurately locating the centers of the gear-shaft bearings. Various types of gages and fixtures are used in machining planer beds and other parts, being usually made specially to suit the varying shapes of the Vs, dovetails and other parts to be machined. Where ordinary flat surfaces must bear accurate relation to one another, standard height blocks are used. These blocks are made of tool steel, and are hardened and then ground and lapped to the required measurement. Blocks of this kind are carried in

Conclusion of the article.

Fig. 14 — Using a gage in planing a dovetail. This gage gives the angular setting for the tool slide and shows where the various cuts are to be taken.

Fig. 15—Checking the squareness of the face of one of the housings of a boring-mill by plumb line suspended from the top.

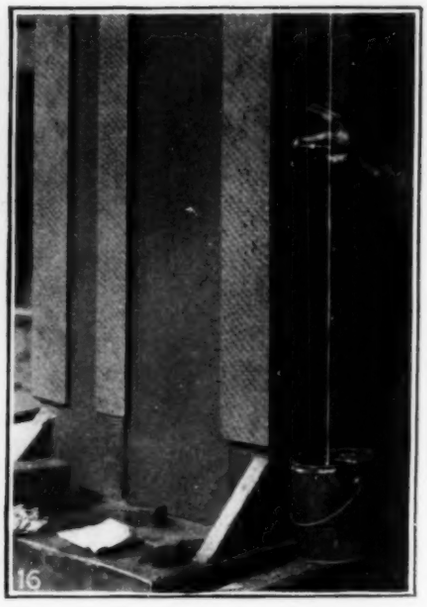


Fig. 16—The same method applied to checking the side of the housing. The type of height gage used between the plumb line and the housing, is shown

sizes up to 10 in. For sizes above 10 in., end measures are used for setting tools to size. Other gages and templets used in planer work are shown in Figs. 11, 12, 13 and 14.

Special foundations have been prepared throughout the erection shop to aid in the erection of the larger types of machine tools. Machines are supported by concrete foundations several feet in depth. Planed cast-iron blocks are placed on top of the concrete, and are set flush with the shop floor. The beds of machines to be erected rest on these blocks.

In squaring up housings of boring mills, planers and similar machines, the use of precision squares is out of the question, as the majority of these instruments in common use have blades not more than 36 in. long, and are entirely inadequate to square up a housing, which, in some cases, is 25 ft. high. A precision level and a plumb line are used for squaring work of this kind. With the precision level, each $\frac{1}{10}$-in. division that the bubble moves, indicates a variation from the horizontal of 0.0005 in. in one foot. With this type of level in the hands of a capable mechanic, this variation can easily be split so that the maximum error will be less than 0.00025 in. per foot.

Steel wedges, evenly spaced at close intervals around the entire bed, are used in bringing the bed to a horizontal plane. Having leveled the bed, the housings are erected, and a plumb line is dropped from the top of each housing at a distance of 3 or 4 in. from the face to be squared. The line used is of the finest silk procurable, and to steady the plumb bob it is immersed in a can of heavy engine oil. After attaching the housings, their weight may sometimes be sufficient to distort the bed to a slight degree, and it must be again leveled before any reliable readings can be taken. It is, in fact, the practice to relevel the bed as the top structures are assembled, so as to counter-

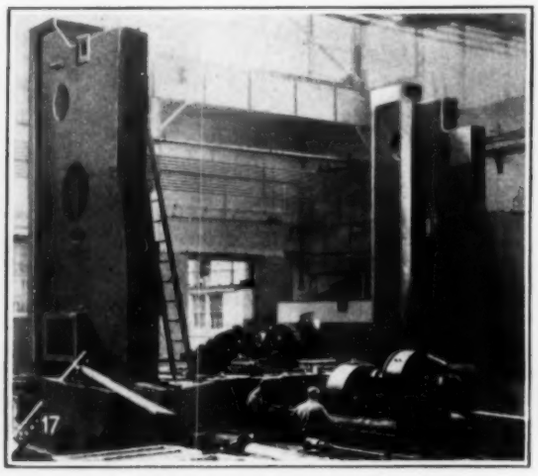
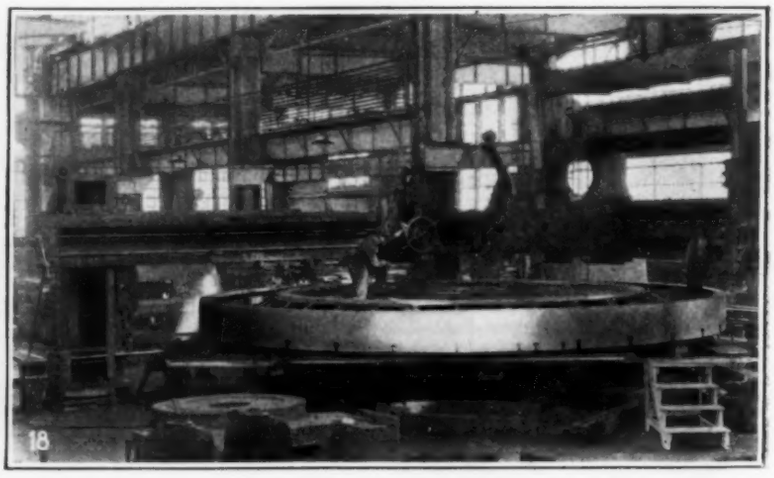
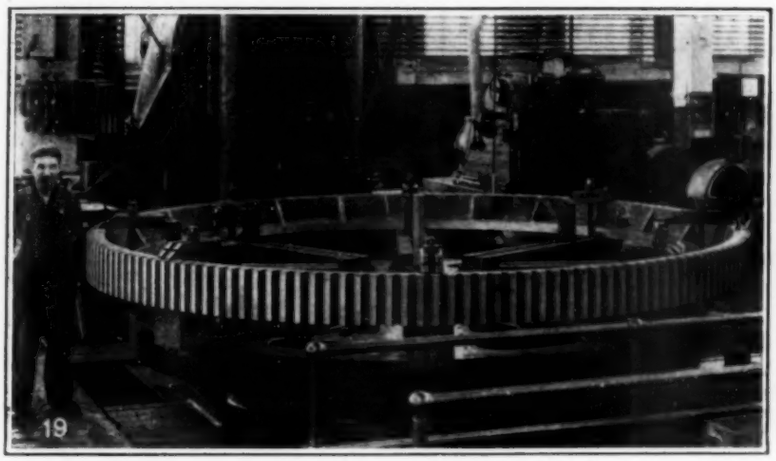


Fig. 17—Erecting a large boring mill. The bed rests on a concrete foundation and the housings have been checked for squareness. It is necessary to re-



check the work each morning in order to allow for expansion or contraction due to changes in temperature. Fig. 18—Machining a 30-ft. boring mill table. The work is larger than the normal capacity of the machine. The housings have been moved back and a temporary cross-rail is necessary



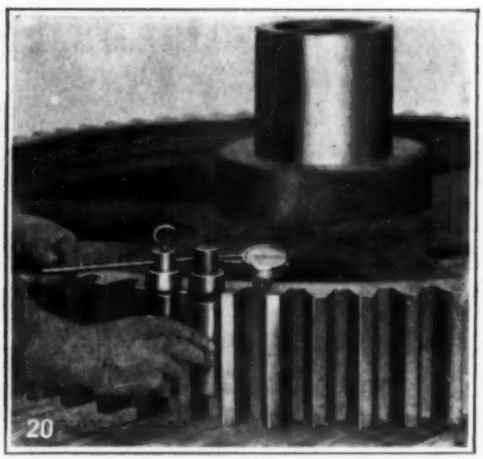


Fig. 19—Generating a large gear. The gear is supported on eight projecting parallels that are bolted to the regular table. Fig. 20—Testing the tooth spacing of a large gear. The dial indicator is mounted on a plug that fits the teeth on the pitch line. By placing a second plug in the adjoining tooth space, the accuracy of the spacing can be checked. Cumulative errors can be found by checking every second or third tooth space

act the tendency of the heavy weights to sag the bed at the points where they are applied.

Fluctuations of temperature are also factors in disturbing the alignment of heavy machines. It is, therefore, imperative that the bed be checked for level *each morning* before proceeding with further erection. Having determined that the bed is level, a height gage is set to the distance between the faces of the housings and the silk line of the plumb bob, and readings taken at both top and bottom.

Housings must be squared in two directions, front and side, as shown in Figs. 15 and 16. Both views show the plumb line and the can of oil used to damp any oscillations of the plumb bob. The type of height gage used and the way in which it is applied are also shown. Any errors found are corrected, usually by scraping the base. If, however, they are too great for this, a light cut is taken over the base of the housing. As a further check after squaring, the distance between the housings is trammed at both top and bottom, and also at the front and back to insure their being parallel with one another. Fig. 17 shows a large boring mill in the course of erection, with the housings in place.

The machining of large units for heavy machine tools requires many ingenious set-ups, as in many cases the size of the work to be machined is far in excess of the normal capacity of the machine on which the machining is done. Fig. 18 shows the machining of a 30-ft. table of a boring and turning mill. The extra capacity is obtained by extending the housings of the boring mill on its bed, and also by attaching an extension arm to the cross-rail. The extension arm virtually becomes the cross-rail, and provides a support for the toolhead as it moves across the table and faces the desired surfaces.

As accurate gears play an important part in the satisfactory performance of machines, all gears, whether herringbone, spur, helical or bevel, are generated. Bevel gears are generated on Gleason machines, the Maag machine being used on other gears. The Maag machine employs a basic rack as the generating agent. One of the Maag machines is shown in Fig. 19 generating the teeth on a large spur gear. The gear is supported on parallels bolted to the table of the machine and forming extension arms so as to handle larger diameters.

Two methods of checking gears are shown in Figs. 20 and 21. The first shows the test for tooth spacing, and includes the use of a dial indicator mounted on a ground plug that touches the teeth at the pitch diameter. The other plug is also ground to the same diameter, and by placing the two plugs in adjoining tooth spaces, it is easy to detect any variation in the tooth spacing as the pair of plugs are shifted from tooth to tooth.

Another application of the indicator is shown in Fig. 21, where a pinion is being tested for concentricity. The ground plug contacts wth the pitch diameter of the pinion teeth, and the button of the dial indicator touches the hub of the pinion, thus any eccentricity between the hub and the pitch diameter as the plug is moved to different tooth spaces.

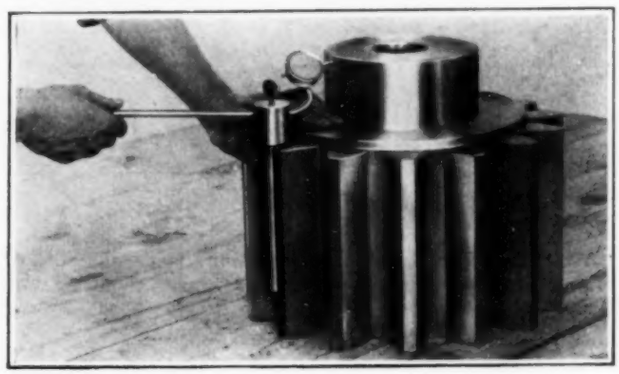


Fig. 21—Testing a large pinion for concentricity. A gage similar to that used in Fig. 20 is employed to test the relation between the pitch line and the hub, which is concentric with the bore

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The importance of good lubrication is shown by tests run in automobile cylinder blocks with irons of various hardness. The softest iron, well lubricated, stood up much longer without undue wear, than did very hard ron inadequately lubricated. Strong, close-grained iron is very desirable in most machining. But good lubrication is even more necessary. Without an oil film constantly between the bearing surfaces, undue wear is bound to occur.

What Is Happening to Business?

By George L. Moore
Assistant to the President, Sherman Corporation

BROADLY speaking, business has been in a period of general prosperity since the depression in 1921. However, especially with regard to manufacturing there have been developments, drifts and currents which indicate an era of "profitless prosperity" to many concerns.

The replies to questionnaires returned by 1,000 manufacturers in all lines of industry constitute in this report the basis for compiling reasons for profit increases and decreases. Although one industry problems may be quite different from another's so that what is favorable to one may be unfavorable to another, yet a study of the returns will give an indication of what is happening to business.

The data have been arranged to show ratios of favorable to unfavorable percentages and of unfavorable to favorable.

Table 1—Favorable-Unfavorable Ratios

Factor	Per Cent Favorable	Per Cent Unfavorable
Money rates	98	2
Employee relationships	93	7
Labor efficiency	84	16
Credits	84	16
Wage scales	81	19
Collections	74	26
Development of new products	74	26
Commodity prices	69	31
Inventory turnover	67	33
Mergers	65	35

Table 2—Unfavorable-Favorable Ratios

	Per Cent Unfavorable	Per Cent Favorable
Competition	91	9
Competition from within industry	87	13
Overproduction	87	13
Profit margins	77	23
Limited markets	77	23
Federal taxation	77	23
Competition from outside industry	76	24
Surplus plant capacity	69	31
Foreign competition	67	33
Local taxation	65	35
Installment selling	63	37
Government regulation of business	62	38

Table 3—What Manufacturers Have Done

	Per Cent Yes	Per Cent No
Reduced unit manufacturing costs	73	27
Reduced overhead	56	44
Reduced sales expenses	29	71
Reduced selling price	54	46
Reduced number of items	27	73
Increased number items	44	56
Purchased new machinery	70	30
Increased inventory turnover	60	40
Increased capital turnover	46	54
Cut down manufacturing time	52	48
Carried on product research	61	39
Carried on process research	61	39
Carried on market research	56	44
Developed new merchandising plans	52	48
Changed wage methods	13	87
Have there been major changes in personnel	14	86
Have you had merger under serious consideration	20	80

An analysis of trends of practice shows some relationship between the profits and the practices of a profitable company compared with an unprofitable one. For example, 86 per cent of the concerns reporting profit increases, said they had reduced unit cost to manufacture. Of concerns reporting profit decreases 64 per cent said "yes" on this point. Of the profit-increase group, 63 per cent said that they reduced their overhead while 52 per cent of the profit decrease group reported overhead reductions. Those ratios—86:64 and 63:52—are of some significance. Sixty-one per cent of the concerns reporting profit-increases, increased volume of sales while only 27 per cent of the companies showing decreased profits had increased their sales volume. Furthermore, only 41 per cent of the profit-increase group reduced selling price while 64 per cent of the decreased-profit group had cut selling price. This is especially significant, as "not getting a fair price" is regarded by many business executives as a key problem in manufacturing today. And the concerns reporting improved profit position reduced expense to sell two to one as compared with the concerns reporting profit-decreases.

The trend of sound practice obviously is toward reduction of unit manufacturing cost; maintenance of selling price; reduction of overhead; reduction of sales expense, and increase of sales volumes.

Magazine Racks for the Shop

AT THE plant of the Continental Gin Company a magazine rack is placed at one corner of each shop for the use of the men. The company subscribes for the leading mechanical and trade papers in any way relating to its work, and sufficient copies are obtained

Magazine rack for shop use

to give a fair circulation. The shop superintendent has the magazines placed in the rack regularly, together with catalogs, descriptive circulars relating to machinery and metals, and other trade literature.

No check of any kind is kept on the papers. The men in the shop are free to take material to their home for reading if they desire. Usually, each man knows that the other men are looking for the latest numbers, and he does not keep the paper away too long.

Labor-Saving Tools from a Southern Railroad Shop

By Frank W. Curtis
Western Editor, American Machinist

Included are a triple-valve lapping machine, a hand-operated boring tool, testing devices for feed valves and dial gages, and a portable machine for grinding-in cylinder heads

AT THE VICKSBURG shops of the Yazoo and Mississippi Valley Railroad, triple-valve pistons and bodies are lapped in the machine illustrated in Fig. 1, which is arranged to accommodate two units at a time. The machine bed is made of a 12-in. channel iron, on which is mounted a 1-hp. motor. Through worm gearing, the motor drives a cross shaft at the ends of which are attached crankplates that drive the connecting rods *A*. The rods in turn connect with the slides *B*, imparting reciprocating motion to them. Triple-valves to be lapped are located and aligned by their flanged faces fitting into counterbored openings in the angle plate *C*, and are held in place by clamping screws as at *D*. Piston assemblies are then placed in the valve bodies and are connected to the reciprocating slides by links. The links can be disengaged while the machine is in motion, thus permitting one side of the set-up to be changed while the other side remains in operation. The time required to lap a valve varies in accordance with its condition, although 30 min. is about the average.

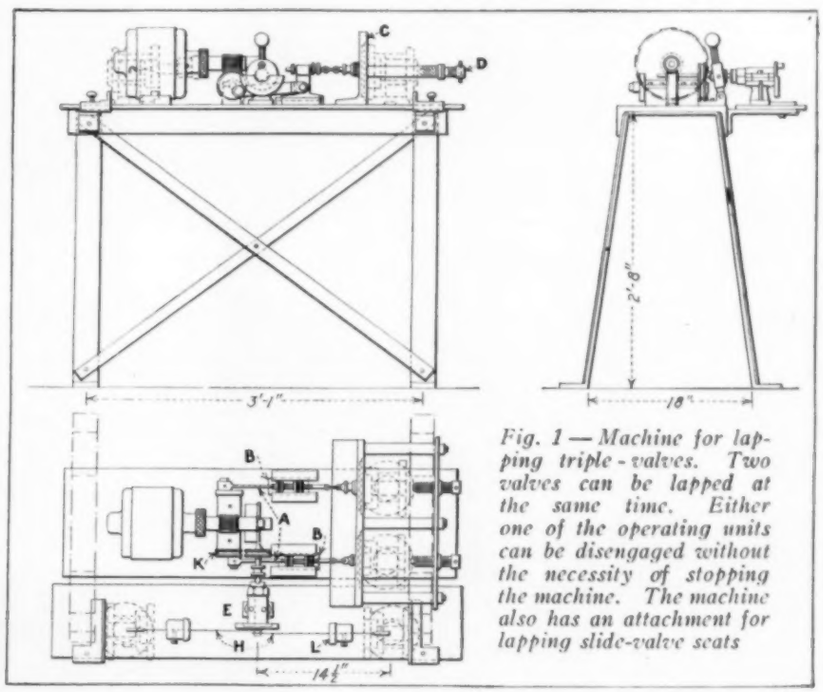


Fig. 1 — Machine for lapping triple-valves. Two valves can be lapped at the same time. Either one of the operating units can be disengaged without the necessity of stopping the machine. The machine also has an attachment for lapping slide-valve seats

In addition to this operation, the machine also handles the lapping of slide-valves and seats, the attachment shown at *E* being used for the purpose. The valve bodies are clamped at each end of the sub-baseplate, after which the slide valves are inserted in their bodies and are connected to the rods *H*, which are driven by crankpins. The crankshaft is belt-driven from the pulley *K*. When not in use, this part of the machine can be disengaged by throwing out a clutch. Lead weights *L* are mounted on the rods to give suitable pressure of the valves on their seats.

The valve chambers of air-pumps are rebored by the hand-operated tool illustrated in Fig. 2, which is clamped to the face of the chamber as shown. The body of the tool, made of hexagon steel, is turned and threaded at the outer end, bored and reamed through the center and has a clamping flange attached at the cutting end. The boring bar, fitting through the reamed hole, has a square shank at the outer end for driving purposes. On the boring bar is mounted the feed sleeve *A* which can be disengaged by means of a latch, so that the bar will revolve independently of the sleeve and likewise will not feed. When engaged, however, the bar feeds 0.05 in. per revolution. The feed sleeve has two nut segments that can be disengaged from the threaded body, thus allowing rapid adjustment of the boring bar to the work. The boring tool is mounted in an eccentric head, adjustable by a setscrew, therefore, by turning the head in either direction, various sizes can be bored. Elimination of a difficult chucking operation is made possible by the device.

Feed valves, after being repaired, are tested for performance as illustratd in Fig. 3, The equipment comprises an air-operated clamp and miscellaneous parts obtained from an obsolete signal valve. The clamping arm is made in the form of a double hook-bolt and is arranged to accommodate all sizes of feed valves.

All gages are inspected for accuracy in connection with a master gage at the testing bench shown in Fig. 4.

The first part of the article. The conclusion will appear in an early issue.

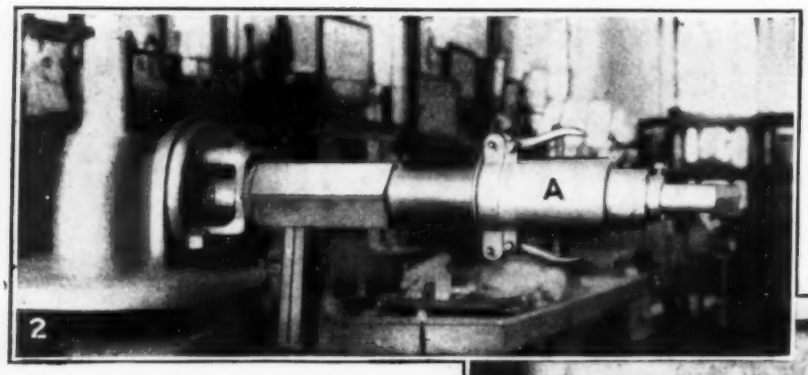
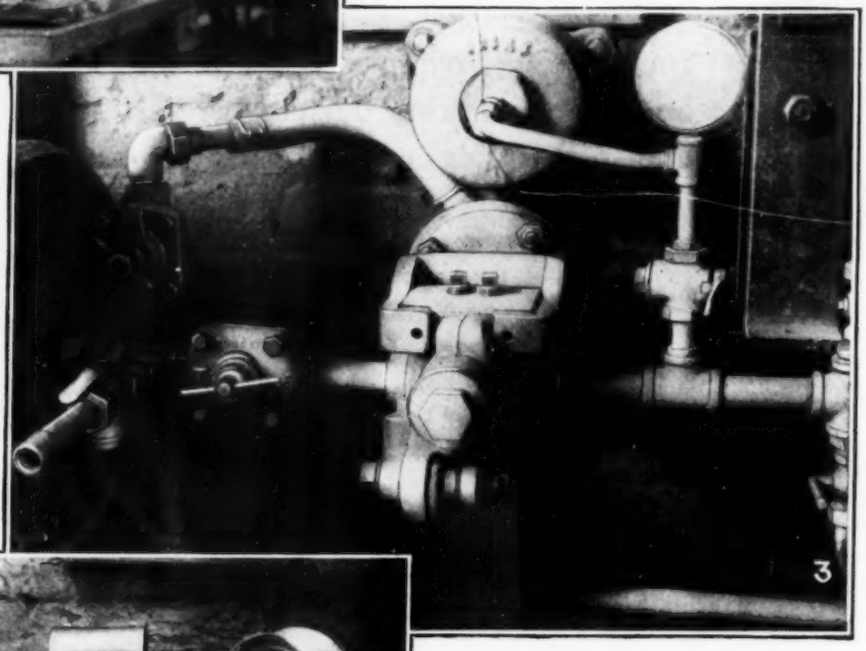


Fig. 2 — Hand-operated tool for boring valve chambers of air pumps. The boring bar rotates in a sleeve provided at one end with a flange for attaching it to the work. The other end of the sleeve has a thread in which a feed sleeve is engaged by two nut segments

Fig. 3 — This device is used in testing feed valves. The main parts are constructed from a signal valve. The work to be tested is held in place by a hook-bolt clamp, operated by air. Provision is made for handling all sizes of feed valves



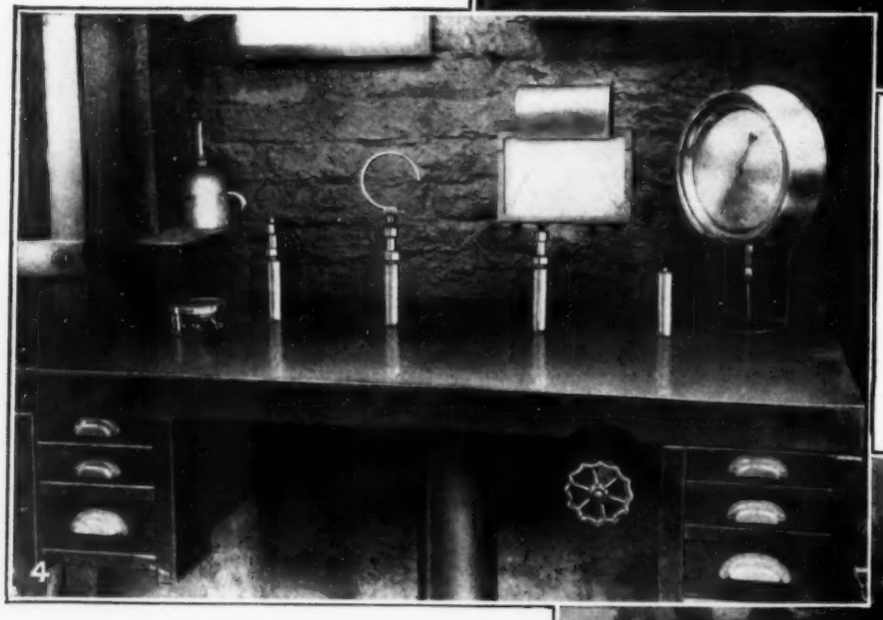
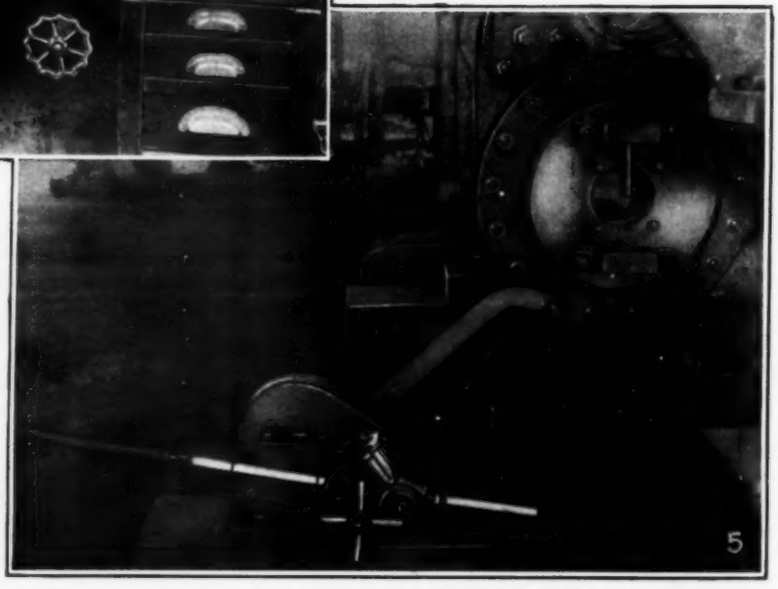


Fig. 4—Gages are inspected by comparing them with the master gage at the right. Pressure is obtained by a cylinder and a plunger operated by the handwheel at the front of the bench. Four gages can be tested simultaneously or individually

Fig. 5—Cylinder heads are ground-in by an air-operated device consisting of a gear drive, a crankshaft and a connecting rod, through which the cylinder head is oscillated. The operation requires about 30 min. The grinding compound is a mixture of abrasive dust and oil



At the right is shown the master gage, while in the center of the bench may be seen four connections to which are attached the gages to be tested. Pressure is obtained by a small cylinder and a piston, operated by the handwheel shown in front near the end of the bench. All piping is placed under the bench top. When one gage only is undergoing test, the remaining connections are plugged. Various nipples and reducers are supplied so that connections of all sizes can be accommodated.

Cylinder heads can be ground-in to make steam tight joints, in approximately 20 min. with the grinding device illustrated in Fig. 5. Driven by an air motor, the unit consists of a reduction gear box, mounted on a base so that it can be transported easily from pit to pit. On the driven-gear shaft is a crankpin to which is attached the driving arm that connects with the cylinder head. In operation, the cylinder head is oscillated 30 times per min. Abrasive dust and oil are used as a grinding compound.

Production and Inventory Budgets

By Thomas R. Jones
The Cincinnati Milling Machine Company

THE budget is not management itself; it is but a tool. It must be applied with a full knowledge and respect for the nature of the business, the type of organization and the personalities of the men responsible for its success.

The proper background for the production budget is supplied by a sales-expectancy estimate. Such an estimate gives consideration to general business trends, expected trends of business for each class of customer served, and the trend of machine-tool usage. These forecasts have sufficient accuracy to permit their use for manufacturing schedules for individual products.

From the standpoint of the production budget, it is necessary to decide whether to manufacture exactly to meet the sales estimate; second, whether to manufacture according to seasonal fluctuations; third, whether to manufacture at a steady rate; or, fourth, whether to supply sales entirely from stock.

To avoid the inefficiencies of fluctuating volume of production, and to maintain the production force, it is best to manufacture at a steady rate and supply seasonal fluctuations from stock. If production is to be varied, it should be held constant over a six-months period.

When production is known, it is necessary to determine the cost of labor, material and burden. Cost records should be kept which show actual hours of labor consumed in the manufacture of each article. From the sales figures the total hours of labor can be found and allocated with regard to yearly production. Figures are obtained for material in the same way. As production is held to certain rates, the material budget is divided into equal monthly amounts.

Three Classes of Burden

There are three classes of burden; fixed, semi-fixed, and variable. The first includes the usual fixed charges which accrue whether business is good or the plant is shut down. The second includes the nucleus supervisory and maintenance organization which will not vary with production, and the third is that part of the expense which is variable in proportion to production.

The ratio of variable or controllable expense to the labor hours should be known as well as the fixed and semi-fixed charges. The sum of these expenses divided by the total labor hours will give the expense hourly cost. It is desirable to reduce budgetary and actual expenditures to the labor-hour basis for purposes of comparison.

The triple classification of expense mentioned, together with the reduction of burden charges to a "dollars per labor hour" basis, permits a quick adjustment of budget to production in the event of unforeseen business fluctuation, and the means of control in such a case would be through the issuance of revised budgets to all budgeted departments. Such changes would be almost automatic in effect. All persons concerned must know that the budget is set on a certain basis of production and that expenses must vary with production.

The forms for the collection of budgetary information should be those used for the collection of payroll, cost and accounting information and no more. The forms used for the dissemination of budgetary information depend, of course, upon what is to be done with that information.

Inventory Analysis

Probably as many businesses have failed through uncontrolled inventories as from any other cause. The purpose of the inventory budget is of course to prevent uncontrolled inventories. It must be made after a thorough study of the sales requirements and the production schedule.

Inventory is made up of four things:

1. The minimum amount of raw stock necessary to carry the business from the time a purchase order is placed to the time the stock will be received in the plant;
2. The amount of process material necessary to keep all equipment busy;
3. Finished parts necessary to balance out inequalities in production rates;
4. Finished stock necessary to give satisfactory deliveries to customers and permit, at the same time, economical runs in the factory.

Once these things are determined, the inventory budget is a simple thing. The responsibility for the first three components rests on the stock supervisor while that of the fourth rests with the management.

The final control of inventory should come under the eye of the man responsible for the financial control of the company. This officer must judge this inventory by the ratio of the total dollars value to the amount of sales per year; second, the ratio of finished stock to the amount of sales per year; third, the ratio of process stock to total sales per year compared with average time of processing; and fourth, the ratio of raw material to yearly consumption of raw materials. This last ratio should be compared with the average time necessary to obtain raw materials from the source of supply.

In conclusion, the mechanism of any budget should be a relatively simple thing. If a concern has correct accounting methods and cost figures, it is only a step to a budget.

Abstract of an address before the American Management Association, Chicago, November, 1927.

· TECHNICAL · ABSTRACTS ·

Heat-Treatment of Aluminum and Its Alloys

Heat-treatment processes in the aluminum field may be classified as follows: (1) Annealing wrought aluminum and aluminum alloys for the purpose of softening; (2) heating aluminum-alloy castings to relieve internal strains, improve machinability, cause accelerated aging, confer permanent growth, and stop leaks; (3) quenching cast and wrought alloys in order to confer hardening power; (4) aging cast and wrought alloys for the purpose of hardening and strengthening after quenching.

When aluminum or one of its light allays is cold worked, the crystal grains are fragmented, broken up, and stressed, but so far as is known, there is no amorphization as the result of mechanical strain. On heating cold-worked metal, the fragmented and strained grains will re-orient and start to grow at a temperature called the recrystallization temperature. At the same time, the metal softens. The recrystallization temperature depends upon the metal or alloy, the presence of impurities and inclusions, the percentage of cold reduction, and other factors. In annealing for the purpose of softening, it is merely necessary to heat the metal to the recrystallization temperature. Heating at too high a temperature or for too long a time (above the recrystallization temperature) or both, are conducive to grain growth. Fine-grained metal has the best mechanical properties.

Two methods may be followed in annealing aluminum and its alloys. In mass annealing, a pan, truck, or car is stacked with sheet, coil, or other cold-worked aluminum, and then charged into a furnace. The time may be from two to eight hours, at 350 to 450 deg. C. (662 to 842 deg. F.). The exact conditions of time and temperature depend upon the nature of the load to be annealed and the method of stacking, these being matters which have to be determined by experience. In mass annealing, the load must be properly stacked so as to permit uniform circulation of heat throughout the mass. Forced circulation of the furnace air is advisable.

The second method is the so-called "flash" annealing which is advantageous from the point of view of quality of the resultant product. With continuous annealing, individual pieces, or stacked at most a few high, are passed through a heated chamber at such a rate of speed that the pieces are exposed to the heat for only a short time. With this method the metal is heated for about 5 to 20 minutes at temperatures in the range of 375 to 475 deg. C. (707 to 887 deg. F.) or even higher. The exact annealing schedule with the continuous process depends upon the size and thickness of the pieces and the percentage of cold reduction. For a given condition, small grain size is produced by annealing at the lowest feasible temperature and for the shortest time.

The so-called hardenable alloys, e.g., those of the duralumin type, must be heated only to moderate temperatures, e.g., 325 to 350 deg. C. (607 to 662 deg. F.), since if heated to higher temperatures and air-cooled they will exhibit the aging effect. In any case, it is desirable to cool slowly in order to obtain maximum softness. Non-hardenable alloys should be heated to 425 to 450 deg. C. (790 or 842 deg. F.).—Robert J. Anderson, *Fuels and Furnaces,* March.

Boring Deep Holes with Oxygen

Oxygen is being used in deep boring in connection with the making of oil well tools. It was necessary to bore a hole 2¼ in. in diameter through the center of an 8-in. shaft of chrome-nickel steel, 30 in. long. The machining time in a lathe was 8 hr. The center of one end of the shaft was heated with a torch and when hot the "oxygen lance" was brought into play. This lance is simply a length of steel pipe connected with an oxygen cylinder by means of a hose. With the center hot from the torch, a stream of oxygen is allowed to flow through the pipe, striking the heated spot on the end of the shaft. The heated metal begins to burn instantly and the slag formed is blown out of the hole. The pipe, being of steel, also burns and must be long enough to allow for this. It must also be fed into the hole as the metal burns away. The burning pipe supplies the heat necessary to keep the cut going and corresponds to the flame of a cutting torch. By properly grinding the pipe, or lance, the hole is kept in the center of the shaft. The burning time was 15 min. for the hole 30 in. long.—*Oxy-Acetylene Tips,* March.

Commercial Spot Welding of Aluminum

The increased use of aluminum in assembled articles has necessitated the development of commercial spot welding of this metal. Accordingly, the question was studied extensively in the laboratories of the Aluminum Company of American. Sheets of aluminum and various aluminum-alloys were used in the experiments.

A special electrode was developed which would not alloy with aluminum. One-inch copper rods having the tips rounded on a ¼-in. spherical radius were chromium plated and drilled longitudinally to within ¼ in. of the end to permit water-cooling. Chromium melts at 2,800 deg. F. which is nearly 1,600 deg. higher than the melting point of aluminum and is hard enough to resist distortion under the required welding pressures. The rounded tip produces a spot uniform in shape and quality while the dishing produced is not deep enough to be objectionable if the current density and pressure are correct. The welding of very thin gages (from 0.010 to 0.020 in. thick) can readily be performed. About 2,000 spots can be made with one pair of electrodes before replating is necessary.

Three factors of importance in welding are time, current and pressure. Judicious adjustment of these factors will allow of making a satisfactory spot weld under circumstances which seem most unfavorable. In working out the conditions for spot welding a particular thickness of metal, the best general rule to follow is to employ as high a current and as low a pressure as is possible without danger of arcing. The following table of approximate values is given to show the requirements necessary for a particular gage of sheet.

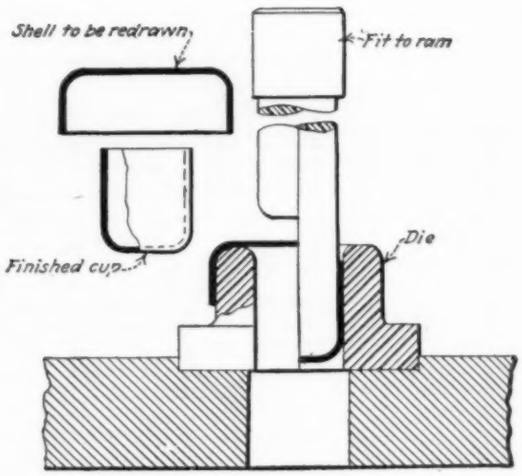
Metal	Thickness of Sheet, In.	Amps. in Secondary	Pressure Lb.
Aluminum	0.20	4,700	60
	0.040	6,800	90
	0.060	8,500	95
Aluminum-manganese	0.020	4,800	60
	0.060	6,800	95
	0.100	8,100	100

Aluminum is easily welded and requires no special preparation. The main requirement for a satisfactory weld is that the metal must be clean and free from dirt or heavy oxide coating, which would prevent metal-to-metal contact. Dirty metal may be cleaned by abrasion or dipping in caustic, followed by a nitric-acid dip to neutralize the caustic adhering to the surface of the metal.

The efficiency of the weld depends entirely on the number of spots to the inch. If a continuous seam is made the weld is stronger than the surrounding metal. About four distinct spots to the inch can be made where necessary. Sheets of dissimilar composition can be welded satisfactorily as well as wrought metal to castings.

The welding of aluminum is a little more difficult than that of other types. Success in resistance-type spot welding seems to depend upon the use of a high current for a short period of time. The tips of the electrodes must be kept clean and properly shaped. The various parts to be welded should be clamped together in such a manner that good contacts are assured in making the welds. Finally, automatic welders should be used so that the time at which the current is shut off may be perfectly regulated; the time element is so important that production suffers if manually-operated welders are used.—By W. M. Dunlap, *Journal,* American Welding Society, February.

Typical Drawing Dies for Sheet Metal



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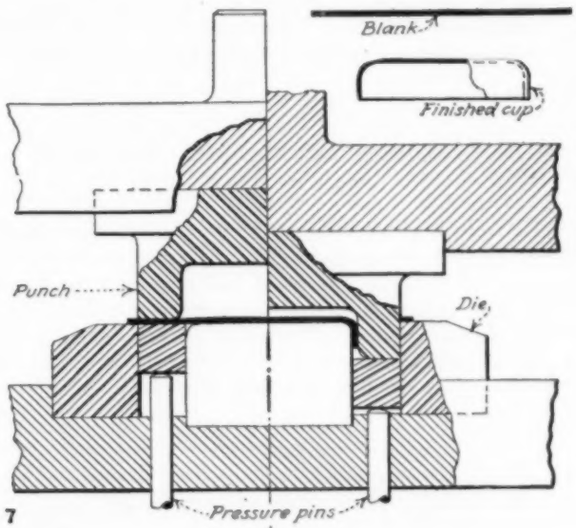

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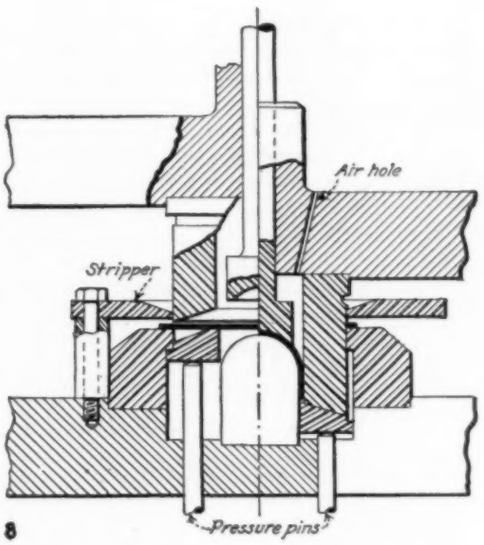

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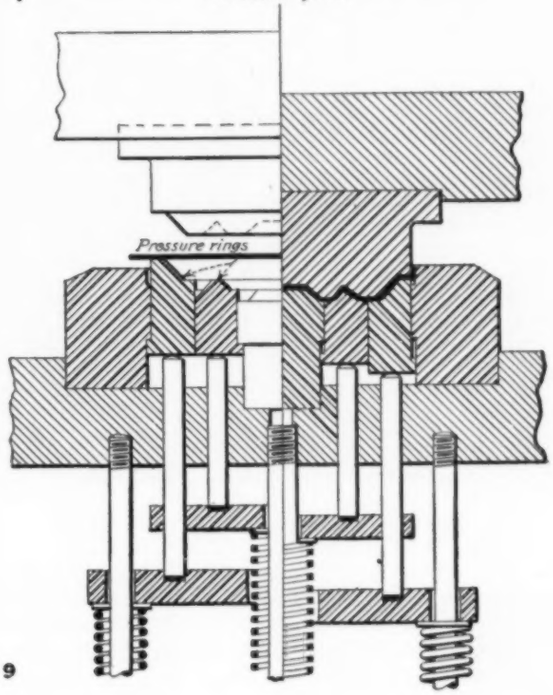

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(Continued from sheet 13)

Fig. 6—Occasionally it is necessary to redraw sheet metal in a die of this type, turning the shell inside out. One of the advantages of the construction is that the reverse draw of the metal insures a shell free from wrinkles. It is used mostly for odd-shaped work, or for drawing metal with low plasticity.

Fig. 7—A simple combination blanking and drawing die. The blank is held between the pressure ring and the punch while it is being drawn over the forming plug attached to the die shoe. Ejection of the finished shell is by means of the pressure ring mounted within the die.

Fig. 8—A die that blanks and draws a shell in one operation. The stripper plate ejects the stock from the punch during the upward stroke of the press, and the pressure ring located within the die ejects the finished shell from the stationary forming plug. The contact face of the punch is made angular to aid the drawing of the metal.

Fig. 9—A combination drawing die that employs two pressure rings. This construction is used for irregularly shaped parts that cannot be formed simultaneously. In this die the outer form is drawn first, thus stretching ample metal from the outside of the blank before the inner form is drawn. The pressure applied to the rings controls the action, the outer ring having sufficient backing to permit the outside to be completed before it travels downward.

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IDEAS · FROM · PRACTICAL · MEN

The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from a minimum of five dollars upwards, depending upon their merit

Storing Sheet-Steel Templets

By J. S. Browne

Where many templets are used for layout work, and are likely to be needed again at infrequent intervals such as in assembling, one plant has arranged the sheet-steel storage shelves and templet storage space as shown in the accompanying illustration. The shelves contain various thicknesses and sizes of sheet steel for making templets as needed, and are located at one end of the assembling floor. A stairway is provided for mounting to the top of the shelves, where all finished templets that

Storing sheet steel and templets

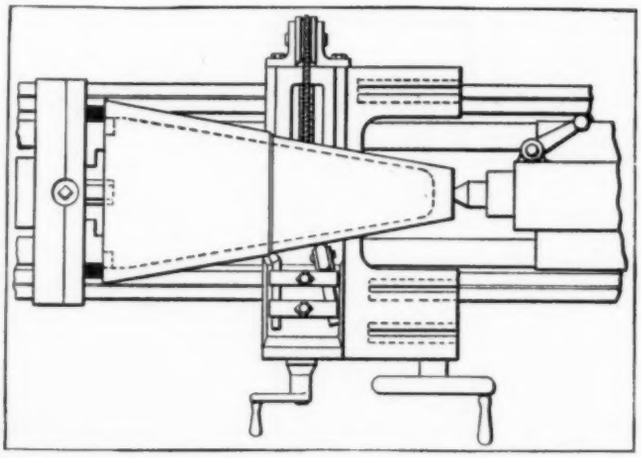
are likely to be used again are labeled and stored. The system has been found to be admirably suited to a shop making a line of heavy machinery where the design changes frequently, and where expensive jigs and regular tool storage are not justified.

Turning a Large Cone

By Jim Henderson
Toronto, Canada

Some time ago our blacksmith shop wanted a large cone for swaging forged rings of different diameters, ranging from about 12 to 40 in. As the only lathe large enough to turn the cone had no taper attachment, the method shown by the sketch was successfully used for doing the job.

The compound rest was used to turn a portion of the small end of the cone to the proper taper. A holder



Turning a cone without a taper attachment

carrying a hardened roller was then clamped in the toolblock together with the cutting tool, as shown in the sketch. The cross-feed screw was removed and a sheave was attached to the back of the carriage. A cable carrying a weight at one end, passed over the sheave and attached to the toolblock by the other end, served to keep the roller in contact with the cone.

After the cutting tool had been adjusted for the proper depth of cut, the longitudinal feed was engaged. Since the roller was kept in contact with the cone by the weight, the tool necessarily followed the taper previously turned on the casting.

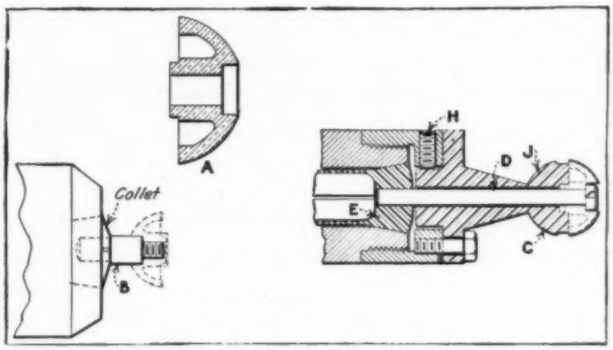
Machining a Half-Ball

By C. S. Hazard

The small, cast bronze half-ball shown at *A* in the illustration, presents an interesting machining problem, since the thin wall and the spherical shape make it a difficult part to grip in a chuck. To provide means for holding, a hole in the center is drilled, counterbored and tapped, the casting being gripped by its hub in a 3-jaw chuck on a hand screw-machine. The casting is then mounted on the threaded arbor *B* and faced and the hub turned.

The threads are removed from the hole in a drill press, using a special counterbore with a long pilot, the work being held in a fixture that locates it by the finished hub. The hole is then reamed to finished size.

For finish turning the outside surface, the half-ball is located by its hub in the recess of a special, hardened nose-piece mounted on the spindle of a bench lathe, as shown at *C*. The work is held against the nose piece by the notched head of the special arbor *D* gripped by the collet *E*. Three setscrews *H* are provided to centralize



Tools for turning a half-ball

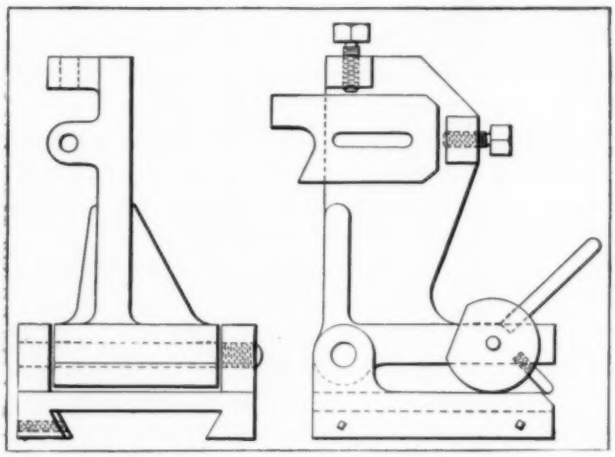
the nosepiece accurately with the lathe spindle. The ball is turned by a tool held in a swinging toolblock pivoted on the bed of the lathe. The surface of the nosepiece at *J* is ground to the radius of the finished ball, so that the work may be checked by micrometer measurement.

A Followrest for the Lathe

By F. A. Patterson

The illustration shows a followrest that overcomes many of the objections to the ordinary type of followrest now in use. It is very rigid and is easily set up.

After it has been properly adjusted on the cross-slide, rotating the eccentric drops it back when it is not needed.



A followrest that is easy to adjust

When brought back into position, it is accurately located by the stop pin arresting the motion of the eccentric. Thus, on duplicate work the first adjustment is the only one necessary.

Staples for Holding Paper on Drawing Boards

By I. B. Rich

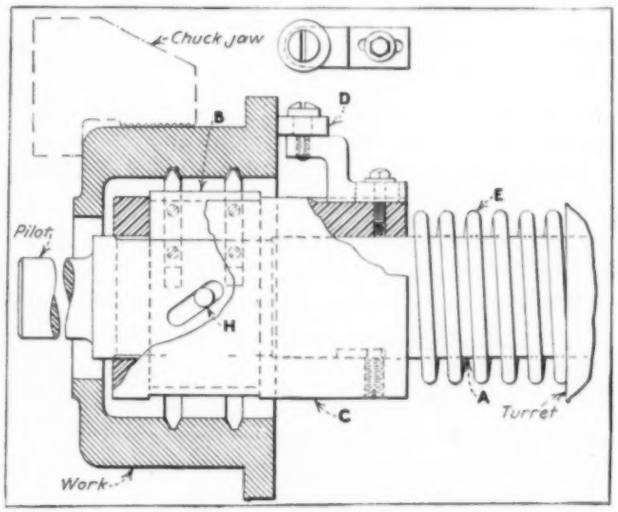
Thumb-tacks, as a means of holding paper on the drawing board, are giving way to wire staples in some drafting rooms. No special stapling machine is required.

Those who use the staples simply take the base off of the regular machine, so that there is no anvil for the staple to strike and be turned over. Instead, the staples are driven into the board at the corners of the paper, and elsewhere as desired, and hold the paper firmly in place. The staples offer no obstruction to the T-square or drafting machine, and are easily removed with a knife or a small improvised crowbar of sheet metal. It is well to advise caution as to getting one's fingers in the way of the staples as they can be driven into the flesh just as easily as into the board.

A Semi-Automatic Recessing Tool

By George H. Feltner

In the illustration is shown a tool for cutting two grooves in the bore of a cast-iron piece held in the chuck of a turret lathe. The tool consists of the bar *A*, held in the turret and piloted at its outer end; the toolblock *B*, carrying two grooving tools; the sleeve *C*, slotted to confine and guide the toolblock; three roller



A recessing tool for cutting two grooves simultaneously

stops (one of which is shown at *D*) attached to the sleeve by brackets; and the helical spring *E*. The bar is cut away to accommodate the toolblock, the cut being wide enough to allow a limited amount of end motion of the bar within the sleeve without moving the toolblock. The pin *H* in the bar engages a diagonal slot in the toolblock.

In operation, the tool is entered into the bore of the work until the sleeve is stopped by the roller striking the front face, which has been machined previously. While the sleeve is thus stopped, the bar is free to continue its movement within the bore of the work to a limited distance. Continued movement of the bar causes the pin to travel in the diagonal slot in the toolblock, thus forcing the block outwardly and bringing the tools into contact with the work. The depth of the grooves is limited by the length of the diagonal slot in the toolblock.

When the turret is moved backward, the spring holds the roller stops against work and prevents the sleeve from being drawn back until the toolblock has been returned to its original position, by the travel of the pin in the diagonal slot. The tool can then be withdrawn from the bore of the work. End movement of the bar within the sleeve is limited by a screw in the sleeve engaging in a slot in the bar. The toolholder can be removed for grinding the tools by taking out the pin that engages the diagonal slot.

American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

Established 1877

How Can Employment Be Steadied?

UNEMPLOYMENT is one of the most serious of the problems that face a community or nation, not alone because of the hardship on those who are unemployed but for the effect on industry as well. For, with any appreciable percentage of unemployment comes the slackening of demand for products, and the laying-off of more men due to the decreasing demand. One of the usual reactions is to blame the increasing use of machinery for replacing human labor, as if labor, rather than the useful products of labor, were the object to be attained. Labor of itself, without producing something of value, has no place in modern civilization.

With so much needed work yet to be done, any proposals to waste human energy are unthinkable. The introduction of machines is not to blame for unemployment but rather the way in which their owners have failed to consider their relation to industry and to the community. Unemployment hurts them all, though in different degrees. Industry will profit as much by studying ways and means of preventing great fluctuations in output as will the employees and the nation as a whole.

How Much for Research?

IT IS now recognized that the big industrial groups that are making the most progressive strides, such as the automotive industry, owe much of their progress to the fact that they have installed in their plants corps of designers and laboratory workers who are working continuously to bring out new and better developments. But apparently it has not yet been impressed on the smaller manufacturer that to live and progress and make a real profit in present day competition he must do the same, and that he may even find it necessary to spend a greater percentage for research than the manufacturer in the larger groups who can profit by the group experience.

How much the small shop can afford to spend for research is an open question, but it is certain that the amount can generally be expanded much beyond the requirements of past years. One relatively small production shop in the Southeast, which has made an extraordinary success of a line of mill machinery that has now become fairly well standardized, still spends ten per cent of its entire payroll in purely experimental development work. This figure is in addition to incidental time spent by the owner and foremen on such work. The tendency is to maintain or to increase this percentage rather than to diminish it. The plant has an experimental shop and a museum. Its policy is to relegate any part of its present product to the museum whenever a better or cheaper way of working is found. The policy is one of progress. Any small manufacturer who considers his product as finished, and quits spending money for development, may find that he is already on the down grade.

Eliminating Waste in Selling

WASTE in industrial production having been recognized and analyzed, and a start made toward eliminating it, the next move should be a similar effort against waste in industrial distribution, or selling. It should be evident enough that such waste exists. What forms does it take?

One of the most obvious is the sending of a dozen or more high-powered salesmen to spend a week or so in the ante-room of a plant that is about to place an order for equipment. Not infrequently the order is finally placed at a profit figure that just about covers the traveling expenses of the man that gets it. The other companies are out the expenses of their man.

Heavy charges for engineering estimates must be absorbed in the same way. The winner of the contract gets his back; the others do not.

But probably the biggest waste, and the one hardest to pin down, is chargeable to entertainment. Christmas presents, theater parties, football game tickets, dinner sets, furniture, liquid refreshments, trips to such amusement centers as New York City, and even money, are disbursed with lavish hand by some salesmen. Details are superfluous. Every one with selling experience can supply his own from what he has seen.

No efficient way of eliminating either of the first two forms of waste mentioned has yet been found. A salesman must go where the business is and get it if he can. The sums involved in installations of modern equipment are so large that the buyer must have accurate estimates before he goes ahead. But entertainment, or at least a large part of it, is sheer waste so far as any good it does is concerned, and worse than that so far as its harmful effects on both parties go.

· SHOP · EQUIPMENT · NEWS ·

Littell Automatic Clinch-Nut Feeds

FIVE types of punch press feeds have been created by the F. J. Littell Machine Company, 4125 Ravenswood Avenue, Chicago, Ill. These feeds fasten clinch nuts to automobile body parts, and their use, according to the makers, will not only speed-up production but will enable manufacturers to fasten clinch nuts in out-of-the-way places. The clinch nuts may be fed from either top or bottom, and the feeds are designed to take flat-sided nuts as well as round ones. Model A, illustrated in Fig. 1, feeds the nuts from the bottom, and lifts the body piece out by means of an automatic lifter. The lifter has a disappearing action so that another piece may be fed to the button immediately. This model feed is for round clinch nuts only.

Model B, illustrated in Fig. 2, is made in two styles, for long and short strokes respectively. This feed was designed for fastening round nuts to body parts that are deeply grooved or curved in such a way that access to the location is difficult. The round nuts are fastened into hexagonal holes, and are curled over the hexagon side of the hole. This operation permanently prevents the nuts from turning. In Fig. 4 this is shown in the lower view.

Model C is a variation of Model A, Fig. 1, as described above, but instead of raising the piece straight up, the automatic lifter on the Model C feed ejects it to the front. This feed is also arranged with a thin anvil so that nuts may be inserted inside of U-shaped parts. A fifth model, shown in Fig. 3 is especially designed for feeding D-shaped or flat-sided nuts, such as shown in the upper view of Fig. 4. This model, which can be supplied to feed the nuts from either the top or bottom, is shown feeding from the bottom.

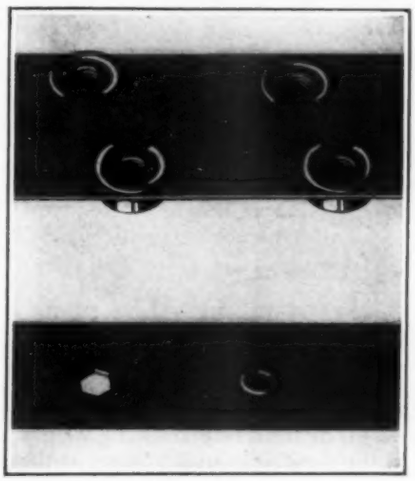


Fig. 4—Typical clinch nuts

All these feeds are so arranged that all the operator has to do is to put his pieces over the clinch nut and trip the press. The next nut is then automatically pushed into place. The average operator can set 25 nuts per minute, while a fast worker can set 40. These mechanisms will handle 80 pieces per min. with ease if the strips are fed rapidly enough.

"Norvell" Packing Cutter

For the cutting and fitting of fibrous packing for piston rods, valve stems and pump cylinders, the "Norvell" packing cutter has been designed by the Chickasaw Machine

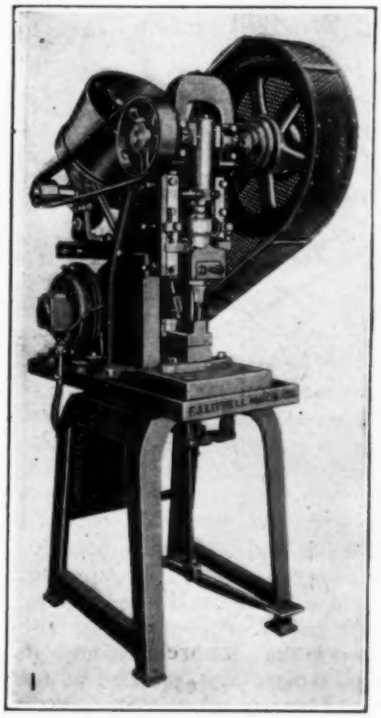


Fig. 1—Punch Press Feed, Model A, feeding from the bottom; body piece ejected by means of an automatic lifter

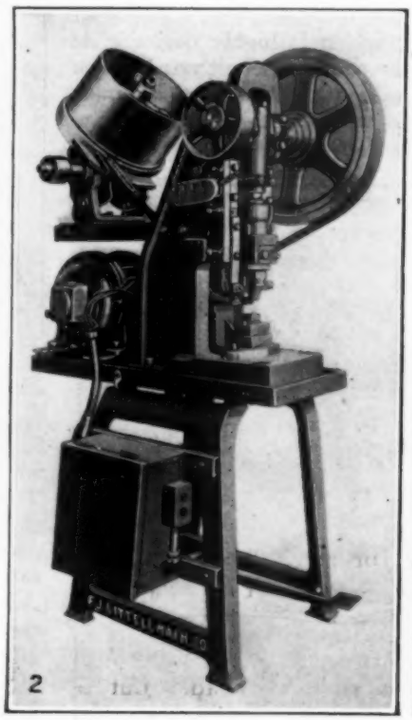


Fig. 2—Model B for fastening round nuts to body parts that are deeply grooved or curved

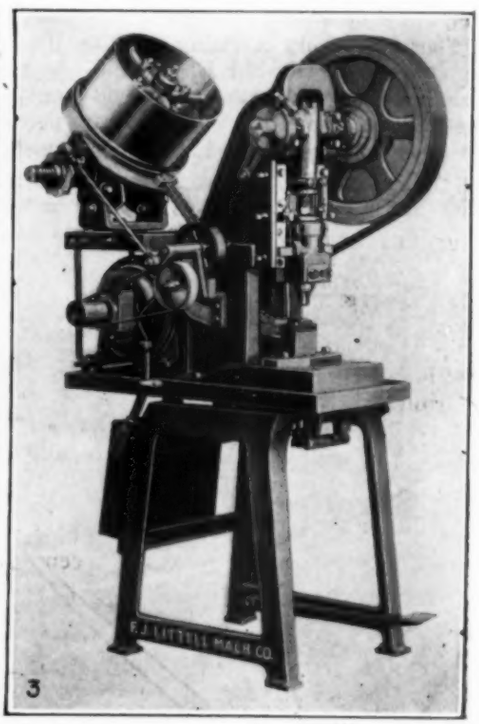


Fig. 3—Model D. Same as Model B for either round, D-shaped, or flat-sided nuts

"Norwell" Packing Cutter

& Foundry Company, Memphis, Tenn. The device will cut packing of any size from ¼ to 1 in. in thickness to fit any size rod, stem or cylinder from ½ to 7 in. in diameter without any previous calculation and without waste of packing. It is claimed that four-fifths of the time of cutting packing is saved.

To set the machine the stop is moved until the line on the stop representing size of packing coincides with the circular line on the dial representing the size of rod, and then the nut is tightened. The beveled end of the coil of packing is taken around the anvil and held against the stop. As the packing is held against the stop and the anvil, the knife is moved forward with the lever. The result is a perfectly-fitting ring.

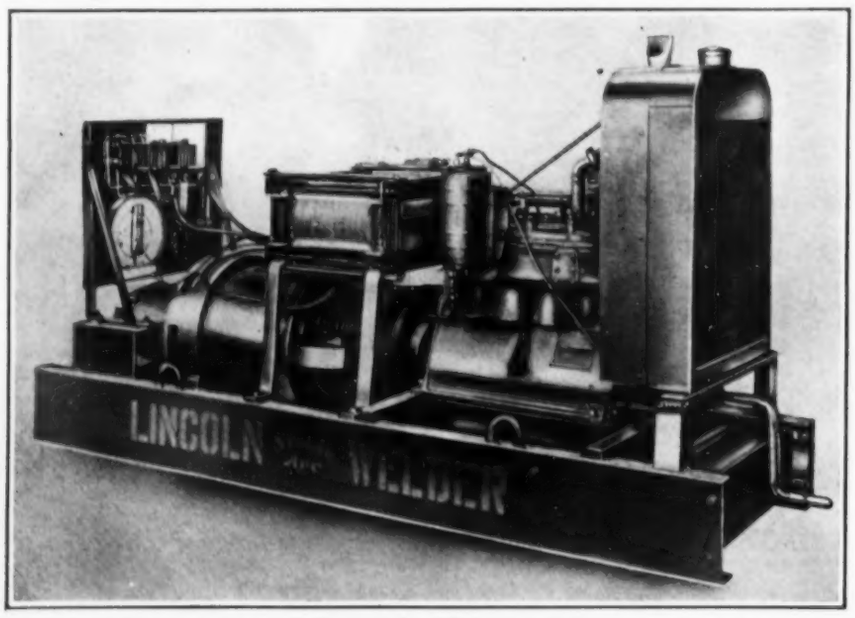
The knife is made of the best saw steel and is actuated by a rack and pinion with teeth cut from the solid. The anvil or body is made of grey iron while the dial is made of etched brass and is permanent. The total weight of the machine is 14 pounds.

Lincoln Gas-Engine Driven Welder

TO MEET the need for a light and sturdy welding unit, the Lincoln Electric Company, Cleveland, Ohio, has announced Model S-1960 "Stable-Arc" welder. The unit is self-contained, is of light weight and is readliy portable since it has its own motive power.

The welder has a rating of 200 amp. according to N.E.L.A. standards, with a current range for welding duty of from 50 to 300 amp. It operates at a speed of 1,500 r.p.m. Motive power is provided by a four-cylinder, type H-9 Continental "Red Seal" Engine. The generator is constructed of steel, thus reducing weight and the possibility of breakage in the field. The complete magnetic circuit of the generator is of laminated structure, thus increasing the stability of the arc which is highly desirable in work for which this unit was brought out, because many times welding must be done in a vertical plane and frequently overhead. A steel switchboard is also provided in place of the usual slate or composition board, still further reducing the possibility of breakage or damage in the field.

The welding generator and engine are mounted on a structural base welded into a solid piece of steel. This welded steel base provides a maximum stiffness and rigidity with a minimum weight, the whole unit weighing only 1,580 lb. The overall dimensions are 76x25 inches.



Lincoln Gas-Engine Driven Welder

"Esso" Cement Gun

For the maintenance of furnace linings, boiler settings, and similar refractory surfaces, the "Esso" cement gun has been introduced by the S. Obermayer Company, Chicago, Ill. The features of the gun include ability to build up a refractory wall from ½ to 1½ in., mechanically mix its own cement, operate on air pressures as low as 30 lb., prevent waste of cement, be operated by one man, and spray 20 gal. with one filling.

The gun is fed by a 20 gal. brazed

"Esso" Cement Gun

tank equipped with an adjustable reducing valve suitable for the air pressure with which the gun is to be used. Two interchangeable nozzles—one short nozzle for places easily reached and a long one for more difficult locations—are also standard equipment. Air and cement reach the nozzles through two 25-ft. lengths of hose attached to the storage tank, and both air and cement are regulated at the gun head by two valves. By varying the amount of air and material, the density of the spray is easily controlled. This enables the operator

to spray evenly and build up a compact, homogeneous patch or covering despite differing conditions.

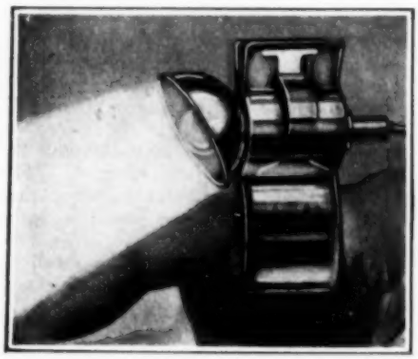
When through spraying the operator has only to close the cement valve, leaving the air on, and let the air clean the nozzle. The left-over cement can be stored until needed at some future date and then remixed ready for application right in the tank. The mechanical mixing of the ingredients is done in the tank by air. Both fresh materials and left-over cement can be mixed this way in a minimum of time and without loss of material.

In addition to the major features mentioned, there are two others which help in saving time. Each of the 25 ft. lengths of hose is fitted with a coupling which clamps on and makes it unnecessary to waste time in screwing the hose on to the tank or on to the gun. A large funnel with a removable 16 mesh screen is screwed into the tank at the top with a quantity measuring device.

All of the fittings and nozzles are made of brass and the steel tank has a coating of brass to protect it. A pressure gage and an adjustable safety valve are included in the standard equipment.

"Digit" Finger Lamp

An unusual lighting device known as "Digit" finger lamp has been placed on the market by the Digit Manufacturing Company, 272 Lafayette St., New York, N. Y. It is nickel-

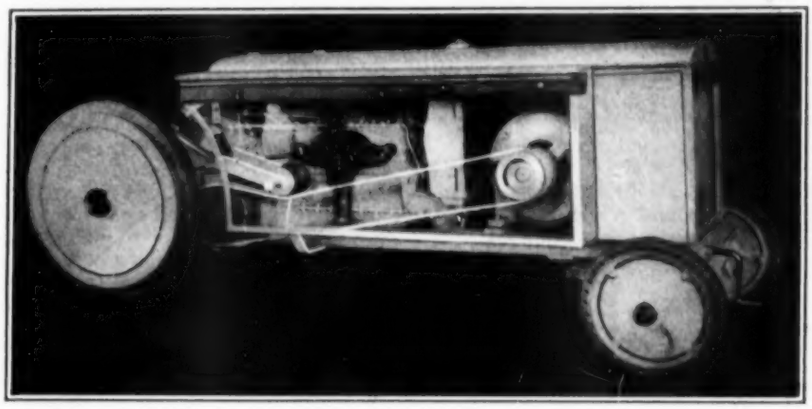


"Digit" Finger Lamp

finished and clamps comfortably and quickly on the finger or on a tool and makes an all-purpose trouble lamp. The lamp uses a 2½-volt Mazda bulb and comes supplied with 4 ft. of special flexible cord with plug.

General Electric Welder Tractor

AN IMPROVED combination of electric arc-welder and Fordson tractor is now offered by the General Electric Company, Schenectady, N. Y. The principal improvements consist of the substitution of more recent welding equipment, the addition of head and tail lights, and a protective cover. This outfit is now being marketed direct by the General Electric Company.



General Electric Welder Tractor

The principal equipment consists of a standard Fordson tractor, belt-connected to a type WD-300-A, 25-volt, 300-ampere (one-hour rating) 1,750-r.p.m., ball-bearing generator. This unit is mounted directly on the tractor and is protected by a metal canopy and canvas side curtains. Other equipment includes governor, power take-off, muffler, waterproofed pulleys on engine and generator, belt and belt-tightener, disk-type rubber-tired wheels both front and rear, extension frame, offset crank, control panel and reactor, head and tail lights and battery and charging control.

The outfit has been particularly designed for use by welding contractors, boiler shops, marine repair shops, structural contractors, oil-well drilling companies, oil refineries, pipe-line owners, tank builders and such applications as require a machine for hard continuous use. The utility of the tractor as a hauling device has not been impaired and the unit will haul equipment and tools to the job and then supply welding current for the work.

The battery, which supplies current for the lights and ignition, is charged while the welding generator is operating. It is provided with ammeter and automatic cutout.

The overall length of the complete unit is 12 ft., the height is 4 ft. 8 in., the width is 5 ft. 2 in., and the net weight is approximately 4,900 pounds.

Westinghouse 200-Ampere Arc-Welder

TO MEET requirements both in the shop and the field, a portable arc-welder has been developed by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa. Outstanding features of this unit are simplicity of operation and compactness in construction.

The set is started by connecting directly across the line by means of a "Linestarter" and "Linestart" motor, with push-button control. A single rheostat varies the arc current over the entire welding range from 60 to 300 amp. by steps of 5 amperes.

The motor-generator and control equipment are assembled in a totally-inclosed frame. The exciter, which is overhung from the motor end, is securely fastened to the unit frame. This type of construction guards the operator against injury, and protects the set from dirt and falling objects.

Steady welding current, insuring thorough penetration and fusion of the weld, is obtained from a con-

Westinghouse 200-Ampere Arc-Welder

stant-current generator. A separate exciter is used to insure high speed of welding and a generator voltage that responds to any changes in arc conditions, thus tending to maintain a constant rate of fusion of the electrode.

The unit is rated at 200 amp. (1 hr., 50-deg. rise) on a resistance load at 25 volts, which conforms to the standard N.E.M.A. rating. The motor is wound for 220 or 440 volts, and is assembled with the necessary connections made for operation from a 3-phase 60-cycle circuit. If it is desired to operate the unit from a 440-volt, 3-phase, 60-cycle circuit, it is only necessary to replace the operating coil on the magnetic starter, and to reconnect the motor leads.

Trade Catalogs

FURNACE, ELECTRIC. The Ajax Electrothermic Corporation, Ajax Park, Trenton, N. J., has issued Bulletin No. 5, describing several motor-generator types of furnaces and equipment. The principles of operation of the high frequency furnaces are discussed. Several photographs are used. The fields of application of these furnaces, as well as a partial list of users and the purposes to which the furnaces are put are included.

GENERAL ELECTRIC PUBLICATIONS. The General Electric Co., Schenectady, N. Y., has issued a series of publications of the loose-leaf type. Bulletins GEA-808A and GEA-137A describe, respectively, forms RA and RL totally-inclosed fan-cooled induction motors and types TS and QS synchronous motors for mounting on compressor shafts. The better lubrication of railway motors, type GE-265, is discussed in Bulletin GEA-921. The repair of the commutators of railway and industrial-haulage motors is described in Bulletin GEA-797. The limit switch, type CR9441-LS424A for use on control circuits only, either a.c. or d.c., is shown in Bulletin GEA-914. Automatic starters, type CR7022, for slip-ring motors are described in Bulletin GEA-467A.

MILLING MACHINES, RADIAL. The Carlton Machine Tool Co., Cincinnati, Ohio, has issued a leaflet describing its line of radial drilling machines. The various features of this line are explained by means of photographs of two views of the entire machine and a close-up of the heavy-duty head. A table of specifications for radials of various reaches is appended. The leaflet has four 11 x 8½-in. pages.

MOTORS, AIR-JACKETED. The Wagner Electric Corporation, St. Louis, Mo., has published Bulletin No. 51, describing its line of air-jacketed motors which are totally-inclosed, self-cooled and pipeless. The line includes single-phase, repulsion-induction motors from 1 to 20 hp., and polyphase squirrel-cage motors from 2 to 30 hp. Essentially the motor is of the totally-inclosed type, but is surrounded with a cast-iron perforated jacket through which air is sucked by means of a fan mounted on the end of the motor shaft. The bulletin is well illustrated with several photographs of individual parts and the assembled motor.

MOTORS, LINE-STARTING. The Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has issued Bulletin No. 1143 covering its line of line-starting induction motors, type ARX. A photographic analysis is used to depict the various features of these machines. A table of the ratings of the motors which are now available is given.

MOTORS, WELDED. The Lincoln Electric Co., Cleveland, Ohio, has published a Bulletin No. 200-B on its "Linc-Weld" motors showing several advances in electric motor construction. The constructional features made possible by the welding process are shown by means of several illustrations. The advantages of standardized shafts, bases and bearings are brought out, while many special motor applications are given. The speed-torque curve is included for a "Linc-Weld" "Switch-Start" motor. The catalog contains 26 10½x8-in. pages which are pleasingly arranged.

REBUILT MACHINERY. The J. L. Lucas Co., 3 Fox St., Bridgeport, Conn., has published Bulletin No. 73 containing a classified listing of rebuilt machinery and miscellaneous items. Complete information is furnished with regard to terms, rebuilding, major specification, equipment, serial numbers and condition of the items listed. Many illustrations are scattered through the booklet, which contains sixty-seven 9x4-in. pages.

Pamphlets Received

CREEP IN STEEL. The Department of Commerce, Bureau of Standards, has issued Technologic Paper No. 362 entitled "Creep in Five Steels at Different Temperatures," by H. J. French, senior metallurgist, H. C. Cross, junior metallurgist and A. A. Peterson, assistant scientific aid. This report describes so-called "creep" tests in which the elongation of metal specimens is observed with time under a fixed load. Tests were made on several steels within a temperature range from 70 to 1,350 deg. F. These creep tests are concerned with the flow in metals subjected to stresses for long periods at elevated temperatures. Charts are given in which the relations are shown between stress, temperatures, elongations and time for each of the steels. Copies may be obtained from the U. S. Government Printing Office, Wash., D. C., for 15 cents.

GOOD WELDING ESSENTIALS. The Wilson-Welder and Metals Co., Hoboken, N. J., has issued Bulletin No. E, by Alexander Churchward, Technical Director, which contains thirteen pages 9x6-in., and several tables of information for guidance in proper welding practice. The advantages of the short arc over the long arc are discussed, while the influence of the length of arc on good welds is analyzed. Several illustrations are included.

HOW TO RUN A LATHE. The South Bend Lathe Works, 425 E. Madison St., South Bend, Ind., has published a pamphlet entitled "How to Run a Lathe." The booklet is indexed and contains 144 8x5-in. pages and has several hundred illustrations. It sells for 25 cents. Its purpose is to aid the beginner or apprentice in the machine shop and the student in the school shop to secure a better understanding of the fundamentals of the operation of a modern screw-cutting engine lathe. In describing modern lathe practice, an effort has been made to show only the best and most practical methods. The treatment of the subject includes care of the lathe, measuring methods, lathe tools, use of the taper attachment, cutting a screw on the lathe, as well as many other simple operations. Several useful tables are included.

PUNCH PRESS NEWS. The F. J. Littell Machine Co., 4125-4127 Ravenswood Ave., Chicago, Ill., has published the first issue (March) of its house organ "Punch Press News." The number is devoted to a description of the automatic feed for punch presses which was recently developed by the company. Fine illustrations are a feature of the publication, which is well arranged. The leaflet has four 10½ x 8-in. pages.

NEWS OF THE WEEK

German Machinery Trade Shows Growth of Import and Unchanged Export

Figures for 1927 reverse of situation in 1926

THE German foreign machinery trade in 1927 showed a reverse of the tendency exhibited in the preceding year: a growth of imports and comparatively stationary exports. The import business points in the direction of a return to pre-war conditions as regards quantity as well as quality. In the development of exports no clear tendency can be observed as the volume fluctuates from year to year without showing any decided progress or decline.

In 1926 the sharply rising import curve received a slight downward inflexion. This bend was generally ascribed to a lack of purchasing power and not to saturation. That this theory was correct is well confirmed by the astounding rise of imports in 1927. They almost doubled within that year and only remained below those of 1913 on account of harvesters, chiefly of American origin, and partly on account of the fact that Germany of 1927 was poorer by several large machinery consuming territories such as Alsace-Lorraine and Upper Silesia.

The development of the German machinery imports from 1920, when it was practically nil, to 1927, can be seen in the following table:

GERMAN MACHINERY IMPORTS

	Metric Tons	Value in Million Marks
1913	68,990	78.3
1922	10,731	*
1923	5,491	11.3
1924	13,282	26.7
1925	38,425	76.6
1926	34,391	67.3
1927	61,827	130.6

* Not ascertained during inflation times.

Imports, although in tonnage below those of 1913, exceed the latter *ad valorem* by 52 million marks. The change in the ratio between value and tonnage is partly due to the generally higher price level, but partly also to the shifting to goods of higher quality.

The increase in imports is a reflex of the generally improved business of 1927. The nationally propagated effort to adjust production to the higher level of wages and the largely increased overhead burden have forced and are still forcing German industry to avail itself of foreign progress, which, so far, German machine buildings have not followed. Naturally the question arises, how far can German machine builders, faced by a narrowed domestic market and a greatly handicapped export business, not to speak of financial obstacles, expect to fill the gaps. In this respect, it becomes even more manifest from year to year, that the machine builders are concentrating their efforts upon certain classes and types of machinery and are leaving others alone, quite resigned to be dependent in this regard upon foreign products.

For the present the trend of the German machinery imports goes into two widely diverging directions: the highly-specialized machine, for which no German substitute exists, or none of like quality; and articles produced in large quantities. Imports now rest on a more stable foundation and are of a more lasting nature than in pre-war times, because on the one hand German machine builders have become very careful of what it does not pay to copy and on the other hand because quantity production on the American scale at present is not possible in Germany.

In view of these facts it is clear that the volume of German machine imports is not evenly distributed over the whole field. There is a distinct discrimination visible in the list of imported goods. The outstanding features are easily discernible in the one or the other of the two groups, mentioned above, that of specialized machines and of quantity products.

The leaders in the import are:

	1927	1926	1925	1913
	Metric Tons			
Tractors, transport and agricultural	3,613	1,361	115	....
Automotive motors	4,669	2,101	1,356	336
Textile machinery, raw material	9,271	4,506	7,712	7,194
Spinning, weaving, knitting machinery	16,525	9,851	9,593	11,909
Machine tools	4,942	2,683	4,508	6,427
Ceramic machinery	1,775	939	1,275	462
	39,795	21,441	24,559	26,328

These classes of machinery represent almost 60 per cent of the total import and 70 per cent of the increase since 1926. Of the other groups, the import of which has a tendency to rise, may be mentioned: woodworking machinery (chiefly of Swedish origin) pneumatic tools, cream separators, machines for grain mills, refrigerating machinery (chiefly of U. S. origin), and stationary internal-combustion engines. In all other respects the import is keeping below the level of 1913. The greatest drop is seen in the case of American harvesting machines, which have been superseded by the Canadian product, and power generating machinery, except internal-combustion engines.

As regards origin, Great Britain is predominant in the textile machinery field. United States dominate the import of motors, refrigerating machines, machine tools, book-binding machines, leather and shoe-making machines, and printing presses. Holland is supplying dredges and machinery for sugar mills, Sweden chiefly woodworking and paper machinery.

Other machinery-importing countries are Austria, France, Czechoslovakia and Poland. Germany is now availing herself to a growing degree of the products of these latter-named countries, obviously on account of their deteriorated currency.

A tabulation of the import of the larger groups of machinery in comparison with the two preceding years and 1913 is seen in the following table:

	1927	1926	1925	1913
	Metric Tons			
Traction machinery	3,896	1,487	195	....
Power machinery	5,755	2,841	1,884	3,198
Textile machinery	26,011	15,003	18,355	20,710
Machine tools	4,942	2,683	4,508	6,427
Agricultural machinery	6,189	3,944	2,772	38,535

The import of machine tools has entirely recovered from the drop experienced in 1926 and has exceeded that of 1925. It was the largest since 1913 and was distributed as follows: 2,040 tons came from the U. S., as compared with 4,200 in 1913 and 1,642 in 1926; 701 tons from Czechoslovakia; 777 from Austria; 496 from Switzerland; 317 from Great Britain; and smaller quantities from France and Holland. The total comprised 18,154 units of an average weight of 270 kg. In 1926 the number of machine tools imported was 6,187 weighing in the average 430 kg., and in 1925, 5,211 machines with an average weight of 860 kg. The drop in the average weight is explained by the large percentage of light-weight machinery. The total value of machine tool imports amounted to 12,610,000 marks as against 6,345,000 in 1926; 13,901,000 in 1925 and 8,900,000 in 1913.

A review of machinery exports shows that much anticipated business in 1927 was not realized. That year was expected to mark another stride in export business, since a foreign sales organization had been perfected, credit facilities again established in a moderate degree, and production processes had become more efficient. Returns now available, however, show that the increase made in 1927 amounted to only 38,000 tons. When the reparation supply is deducted, this figure dwindles to 14,000 tons, or an increase of only 3½ per cent.

A better aspect is gained from the value figures. The average price per ton of exported machinery has risen from 1,800 to 1,900 marks, about 5 per cent. The total amounted to 870 mil-

Export Figures of the Chief Groups of Machinery

	Metric Tons				Value in Million Marks			
	1927	1926	1925	1913	1927	1926	1925	1913
Steam locomotives and traction engines	24,039	19,674	32,957	77,911	44.0	27.3	41.6	77.7
Power generating machinery (exclusive of electric motors)	51,384	46,192	41,224	65,261	95.0	83.4	73.1	111.4
Textile machinery	58,203	57,213	58,630	58,449	162.0	151.6	140.0	101.2
Agricultural machinery	41,856	48,623	42,097	63,770	40.0	46.4	40.7	51.2
Cranes	11,822	8,916	5,488	9,222	10.7	9.5	5.7	7.5
Pumps and fire engines	10,715	10,365	10,898	15,170	25.0	21.9	19.5	19.1
Machine tools	59,583	60,621	45,183	74,336	111.0	93.7	77.4	81.8
Woodworking machinery	9,578	9,229	10,223	12,222	15.0	13.4	15.2	12.4
Machinery for grain mills	7,533	5,872	6,408	13,944	12.5	10.5	10.6	15.6
Pulp and paper machinery	12,337	7,829	7,442	10,668	16.0	9.5	8.5	9.0
Hoisting machinery	12,445	6,873	6,957	14,586	16.8	10.4	9.7	12.5
Ore dressing machinery	7,344	4,744	4,248	13,705	8.0	4.9	4.2	9.6
Machines for the Ceramic industry	10,848	7,181	7,338	18,909	11.0	7.8	7.5	14.4
Printing presses	12,801	10,872	12,301	12,209	37.5	30.9	34.5	22.2

lion marks as compared with 713 in 1926 and 610 in 1913. In the first-named figure the reparation supply amounting to 45,600,000 marks is included. The net increase since 1926 was therefore 112 million marks.

The reasons given for the stagnation of machinery exports are identical with those heard in previous years: import restrictions in Germany's chief foreign markets; money deterioration in many countries; still-prevailing antagonism in former enemy countries; and sharp competition of other machine building countries. Besides these obviously valid reasons it is, however, a fact that the German machine builders are only slowly adjusting themselves to the changed conditions in the world's market. The market for cheap, standard machinery has been lost in many countries that have developed industries of their own and in other respects the German quantity production has been outrivalled by countries like the United States, where production on a much larger scale permits of sales at lower prices than German manufacturers are able to quote.

Traction Engines Gained

Traction engines (chiefly railroad locomotives) have enjoyed a better business than in 1926. The chief countries of destination in Europe were Belgium, France, Italy, Holland and Russia; in South America, Brazil, Argentine; and further British possessions in Africa and India. Tractor exports did not seem to make headway. They went to Russia, Poland, Hungary and Roumania.

Power generating machines, too, showed a rise in export due to an increase in internal-combustion engines and hydraulic turbines, while steam engines and steam turbines experienced a further drop. In textile machinery, the turnover of 1927 was almost identical with that of 1926. The leaders in this field are sewing machines, machines for cotton mills, weaving looms, stocking machines and cloth dressing machines.

The drop in exports of agricultural machinery affected nearly all categories, chiefly harvesters and threshing mills. A slight drop also is seen in the case of metal-working machine tools. This drop would have been much larger were it not that in 1927 Russia bought 16,900 tons of German machine tools as against 5,800 tons in 1926. This export exceeded even that of 1913, the highest on record in pre-war times, by 3,000 tons. Exports in 1927 comprised 262,731 single tools at an average weight of 230 kg. as against 104,000 at a weight of 580 kg. per unit in 1926. Of the 262,731 machine tools exported in 1927, 1,225 were sold on reparation account. In 1927, the average price for machine tools per 1,000 kg., was 1,840 marks as compared with 1,540 marks in 1926. The lighter average weight of tools exported explains this difference.

The export to Denmark, Greece, France, Italy, Spain, Egypt, Chile and the United States was lower. In all other of the more prominent countries, it was higher. The sharpest drop was experienced in the case of Italy and the United States, while the largest rise was seen in Russia. Of the other items an increase of the export is noted in the case of paper-making machinery, in the main due to increased sales to Finland, Sweden, Great Britain, and Holland; of hoisting machinery, in which increase Russia and Japan took the major share, and of ore dressing machinery, printing presses and machines for the ceramic industry. In all other cases the export was either stationary or weaker.

Remarkable progress has been made in machinery exports to Russia, which in 1927 absorbed 62,603 tons of German machinery as against 34,313 tons in 1926. In 1913, the export amounted to 100,994 tons. The improved Russian business is a result of the 300 million mark credit granted the Soviets. In 1927 the total machinery export on reparations account was only 23,875 tons as against 27,824 tons in 1926.

High Production Costs Greatest Handicap to Swiss Export Industries

Importation of all raw materials adds to problem

ACCORDING to a report issued by Assistant Trade Commissioner Kenneth M. Hill, of Berne, the Swiss machine industry in 1927 was moderately favorable, with a slight trend upward, as compared with the two previous years. On the other hand this slight improvement is somewhat deceptive, for competition continued to be very keen in all of the world markets. Moreover, the practical completion of the railway electrification program is about to deprive the industry of one of its principal domestic customers. Occasional rush orders have tended to give a false impression of activity to many factories that were obliged to work night and day for a few weeks after which they practically closed down for a time.

High production costs have long been and apparently continue to be the greatest handicap to all Swiss export industries. Not only must all raw materials be imported, with the exception of water power, but the internal transportation rates are high and the wage scale is one of the highest in Europe. Switzerland is one of the few countries in the world that pays its public employees more than the employees of private industry, with the result that any reduction of labor cost in private industry is precluded.

The Swiss are equipped with cheap water power, an abundance of capital and skillful technicians. According to a leader in the industry, Dr. Hans Sulzer of the firm of Sulzer Freres, these factors must be utilized in a general reorganization of the industry both as regards production and distribution. On the production side he believes that as raw and semi-manufactured products must be imported, Swiss machinery manufacturers must organize their purchases to meet the selling combines on their own ground; that they should produce only the highest grade goods, thus maintaining the quality reputation of Swiss machinery on the world market; that the manufacturing plants should be modernized not with a view to mass production but rather to the perfecting of technical methods and factory organization; that the present law regarding the maximum hours of labor should be made less rigid. As regards distribution, Dr. Sulzer suggests that the railroads be forced to reduce freight costs, that long term tariff treaties be entered into with a view to stabilizing exchange; and that branch factories be established abroad or a licensing system developed for manufacture abroad under Swiss patents.

The production of high grade textile machinery has always been one of the strongest as well as oldest branches of the Swiss machinery industry. The style difficulties encountered since the war by the lace and embroidery industries of the St. Gall district have had their effect on the textile machinery trade, but this condition is gradually being alleviated. In general the machines installed in the St. Gall factories are of a special type and are incapable of being converted to other purposes. Since this machinery represents an outlay of

many millions of francs, the manufacturers prefer to let their factories remain practically idle awaiting the return to style of lace and embroidery rather than scrap present installations and convert their factories to other uses. At the same time there is a very considerable amount of second-hand machinery on the Swiss market at present and a great deal is being exported.

During 1927 exports of textile machinery were valued at 41,726,000 francs, an increase of 7,000,000 francs over sales in 1926. Germany, France and Italy are the largest purchasers, taking slightly more than half of the total. The relatively small importation into Switzerland is entirely dominated by Germany.

Switzerland imports a considerable quantity of manufactured and semi-manufactured parts, while its exports of this item are negligible. Its 1927 imports valued at 2,423,000 francs varied little from the imports of preceding years. The largest sales were naturally to the nearby European countries, but sales to Latin America and to some extent the Far East have been increasing in importance. Approximately one-third of the imports were of American origin.

MACHINE TOOL IMPORTS

Machine tools came largely from Germany, which supplies about 75 per cent of the total value imported. The United States and France are the only other countries of any importance supplying about 10 and 9 per cent respectively, of the 1927 imports valued at 9,855,000 francs. Imports from the United States are of the highest grade, averaging in 1926, 58.2 francs per metric ton, whereas imports from Germany averaged 23.2 francs. Based on tonnage, exports are only about one-half of imports, whereas in value exports exceeded imports, showing clearly the superior quality of the exports. Leading markets for Swiss machine tools are France, Germany, Great Britain and the United States in the order named. Exports to the United States were valued at over 800,000 francs, but the average price per ton was 91.8 francs against an export average of 50.6 francs.

It will be seen from the foregoing that while Switzerland is predominantly a machinery exporting country it does furnish a market for many specialized and semi-manufactured products. Its proximity to the great machinery industries of Germany and France, however, with their consistently lower prices will continue to make it very difficult for American machinery to compete on the Swiss market.

Russia Buys Machinery

Reports that $1,000,000 worth of American dredge, drilling, mine and laboratory equipment has just been shipped by the Amtorg Trading Corporation, American representatives of the Soviet government, to Russia, with the Soviet Gold Trust or Soyuz-Zoloto as the consignee, have been made public. The machines will be used to increase Russian gold production. One purchase was electrical equipment valued at $100,000 for dredges which are being built in the Soviet Union. The principal purchases were made from the Yuba Manufacturing Co., Keystone Driller Co., United States Steel Products Corporation, General Electric Co., New York Engineering Co., Oil Well Supply Co. and the American Cyanamid Company.

Coated Abrasive Products Conference Planned

A general conference of consumers, technical experts, distributors and manufacturers interested in coated abrasive products will be held under the direction of the Department of Commerce, Washington, D. C., on April 11, 1928, to consider the drafting of a simplified practice recommendation for this commodity, according to an announcement by the Division of Simplified Practice.

For a number of years, the announcement points out, the quantity of sizes and varieties of abrasive paper and cloth has been increasing at a rapid rate. At present there are many thousands of varieties being carried and catalogued by the industry. It has been estimated that the annual output amounts to more than $16,000,000. The conference is being brought about through the action of the Abrasive Paper and Cloth Manufacturers' Exchange in submitting a tentative proposal for eliminating the superfluous and seldom called for sizes and varieties of coated abrasive products.

Century of Progress Hailed by American Institute

A century of progress in science, industry and commerce was reviewed at the Centenary Dinner of the American Institute held in the Waldorf Astoria Hotel, New York City, on March 21. The speakers were Edwin F. Murdock, president of the Institute; Thomas A. Watson, Bell's associate in the invention of the telephone; Dexter S. Kimball, dean of the College of Engineering, Cornell University; Julius Klein, director of the Bureau of Foreign and Domestic Commerce; John H. Finley, editor of the *New York Times*. Frederic W. Wile, Washington newspaper correspondent, was toastmaster.

The occasion was marked by the publication of a large volume "A Century of Industrial Progress" edited by Mr. Wile, with a foreword by Herbert Hoover and chapters by 30 industrial leaders, including Julius Klein, Charles Schwab, Dexter S. Kimball, Owen D. Young, Frank B. Jewett, John N. Willys and James G. Harbord. Copies of this book, issued by Doubleday, Doran & Company, were distributed for the first time at the dinner.

The first speaker, Mr. Murdock, outlined the activities of the American Institute since its formation in 1828. "During the past century," he said, "the Institute has contributed greatly, by exhibitions, encouragement of industrial legislation and in other ways to the development of invention and industry. Encouragement of fundamental research," Mr. Murdock declared, "is the great present need."

The relative newness of many great inventions which have become part of the very fabric of modern industrial civilization was dramatically illustrated by the presence of Thomas A. Watson, the first man to hear electrically-carried speech.

Secretary Davis Declares Wages Must Not Come Down

"As spring advances, the present unemployment is fairly certain to be relieved if not wiped out," says James J. Davis, Secretary of Labor in the April 1 issue of *Forbes Magazine* (N. Y.). "The vast Government building program, the naval additions, the Mississippi flood prevention measures, the building of public roads, and the nation's probable ten-billion-dollar building program by private enterprise, will absorb much of the present unemployment. In a roundabout way, it may absorb it all. I do not mean that all those now out of work will be engaged on these building and engineering projects. But the employment of many men in these will lead to the re-employment of the others in their regular trades. The first thousands, wherever they are employed or re-employed, will begin to buy and create work for others to do in supplying their demands.

"Sooner or later, however, some system will have to be devised for metering mass production, so that it will not get too far ahead of our power to consume it. This will take careful thought, but the safety of the country demands that thought be given it. The problem is so grave and complex that no man can solve it alone. It will take time, and it calls for the best suggestions of the best minds we have.

"But one thing is imperative—wages must not come down. If we lower the purchasing power of the country, our products will go unsold, no matter how careful we are of production."

$1,000 Bequest to U.E.S.

A bequest of $1,000 has just been received by the United Engineering Society through the will of the late Oberlin Smith, president of the American Society of Mechanical Engineers in 1890. Mr. Smith founded the Ferracute Machine Company, engineers, Bridgeton, N. J., and was its head. He invented and designed most of the Ferracute company's products consisting of some automatic machinery, but chiefly presses and dies for stamping and for treating metals of various sorts.

The Business Barometer

The outlook in Commerce, Finance, Agriculture and Industry

By THEODORE H. PRICE
Editor, Commerce and Finance, New York

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AN ENGLISHMAN who operated heavily on the London Stock Exchange is reputed to have said "When I buy for a rise I open a magnum and invite the crowd to drink with me, but when I sell for a decline I take a liqueur quietly and alone." The remark is a revealing one, for it helps to explain the contagion of a bull market as well as the popular belief that a bear must be wicked and that those who venture to suggest that prices are too high have an anti-social purpose. If the 18th Amendment had not stood in the way many magnums might have been opened in Wall Street last week, and it may be that not a few celebrations were privately held by some of the numerous winners in the greatest stock boom on record. It has so strained the machinery of the Stock Exchange that the brokers and their clerks are exhausted and out of sheer weariness the market was quieter on Friday and Saturday.

But this is not to say that the advance has ended, nor does the record of the past encourage the belief that a movement so extraordinary will end until something sensational has happened to change public sentiment. Those who remember the panic of 1907, or the Northern Pacific Corner of 1901, will realize how difficult it is to put out the fire of a world-wide speculation by anything less than an explosion that will destroy the structures upon which it might otherwise feed, and nothing of the kind has occurred as yet.

There is, in fact, much to indicate that the conflagration is spreading, for the cables tell of unwonted activity on the stock exchanges of London and Paris, and a message from Brussels says that "the fever of speculation that began with the depreciation of the franc has been growing worse ever since, and hundreds of office workers are going without their lunch to save a little money with which to gamble in stocks." The history of finance supplies no precedent for a boom that embraces two continents simultaneously, and while most men of experience agree that it has created a dangerous situation, they are also agreed that no one can measure its duration. It reflects a psychological condition that is contagious and likely to spread until something happens to turn the tide and the profits out of which metaphorical magnums may be bought have disappeared.

In the United States one of the most recent manifestations of this psychological condition is the advance in commodity exchange memberships that occurred last week. These memberships are called "seats" and following the sale of a Stock Exchange seat at $375,000 there has been a sharp advance in seats on the Rubber Exchange, the Cocoa Exchange, the Coffee and Sugar Exchange, and the New York Produce Exchange. Cotton Exchange seats also rose slightly and it is probable that they would have advanced sharply if it had not been for the investigation in Washington. A plan to bring all the exchanges named under one roof is the ostensible reason for the rise, but as it has no chance of success there are many who regard the sudden demand for seats on these commodity exchanges as the harbinger of an inflationary advance in commodity prices.

Because the staples of human consumption have not been much affected hitherto by the advance in securities, most economists have not until now been willing to admit that the stock boom was due to inflation. But the recent strength of wheat and corn plus the sudden demand for seats on the commodity exchanges is causing a revision of opinion, and some now are predicting an early outbreak of speculation in everything that can be bought for future delivery.

This prediction is sufficiently plausible to catch the imagination of an excited public, and if it is realized an advance in all forms of merchandise would follow speedily and inevitably. In alluding to a possibility that would be so regrettable no endorsement of the predictions referred to is implied, but "all signs fail in dry weather," and the writer would be recreant to his duty if he did not point out the hazardous as well as the reassuring features of a highly complex situation.

In the circumstances caution is about the only worthwhile advice that can be offered, and while prudence in avoiding all avoidable commitments may cut down profits it seems to be the wisest policy until the speculative hurricane that is now sweeping the financial seas has subsided. That it is a policy which many business men have adopted already would seem to be indicated by the slackness of distributive trade and the meagre statistics that are available. Car loadings for the week ending March 17 were 6 per cent under last year, and the February net earnings of 44 railways are 3.4 per cent under the same month in 1927.

In the market for both cotton and woolen textiles comparative quiet prevails and March leaves the steel industry about where it found it. An increase in the sale of automobiles is reported by the trade journals, and it is rumored that Ford will be producing 5,000 cars a day by the first of July.

Conditions abroad continue to improve. In Europe as here the speculative distention is the only disturbing feature. In Mexico Ambassador Morrow seems to have done good work in bringing on a better understanding of and with the United States, and in Canada prosperity appears to be increasing. About the only thing that we have to fear is the Stock Exchange boom. The sooner it is checked the better off everyone will be.

WHAT'S DOING IN INDUSTRY

REPORTS coming in from various parts of the country indicate that March business just about held its own over January and February, considering the difference in working days in the latter case. It is conceded, however, that conditions are better than for the same period a year ago. Conditions have reached a steady level, though by no means a low one. In fact, there is every indication of much activity in the metal-working field.

AUTOMOBILE manufacture continues to be the high light of activities in Detroit, Indianapolis and Milwaukee, and naturally machine tool centers, such as Cincinnati and Cleveland, have reflected this activity. Builders specializing in equipment for such shops, particularly, are working overtime, although automotive buying as a whole is a little disappointing.

WOODWORKING machinery has been sold in volume in the past month, and as various appropriations for roads are announced, road-building equipment also is being sold in good volume in many centers. Building contractors have enjoyed prosperity for some time, and as a result structural shops have been busy. In Canada boom times are on.

ANOTHER indication of metal-working activities is the fact that grinding wheels, chucks, twist drills, vises and other small tools are being sold in large quantities all over the country.

The Industrial Review

Weekly progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

NEW YORK

Now that the first quarter of 1928 has passed, the consensus of opinion among machine tool dealers in the metropolitan area is that the year has gotten off to a good start. In retrospect, these three months have proved to have been more than fair and about equal in volume. Here and there a few big orders stood out, but the general run of machine buying has been single tools, well scattered, although about eight firms have been steady buyers for some time. In the past week, however, at least one firm obtained a record-breaking order.

With few exceptions, there have been many indications of activity in the metal-working shops in this vicinity. A fair volume of business is being done in grinding wheels, and there is a good market for twist drills, milling cutters, hobs, chucks and vises, also electric drills. Sales in these items would indicate that considerable production is under way or contemplated for the near future, and that the small shops are busy, as these small tools furnish the bulk of small-shop purchases, rather than machine tools.

The E. W. Bliss Co., of Brooklyn, was recently awarded a contract from the Navy for 22,000 shells. The Wright Aeronautical Corporation is producing about 90 engines per month and is expanding its plant to produce 150 engines. This company has been a steady buyer of equipment in the past month. The Fairchild-Caminez Co. is also busy and is expanding its facilities. The International Motor Co. has been slowly increasing its output, and is replacing obsolete machines and making some changes in set-up. Other plants that are busy in this vicinity are Gould & Eberhardt, the Hyatt Roller Bearing Co., the Otis Elevator Co., the Singer Sewing Machine Co., R. Hoe & Co., and the Mergenthaler Linotype Co. All of these companies have been buyers of equipment.

Some of the machines sold in New York for outside consumption included: five lathes, two 6-in. vertical shapers, three bench lathes, two bench millers, two jig borers (two makes), an 800-lb. steam hammer, a speed lathe, and a tapper. A large manufacturing plant in Connecticut bought a 36-in. x 44-ft. lathe. The Lukens Steel Co. bought a Niles 10-ton, 85-ft. crane. A concern in Harrisburgh purchased a rebuilt Ajax forging machine, while a company on the West Coast obtained several woodworking machines.

CINCINNATI

Reports of a few of the machine tool manufacturers in the Cincinnati district in regard to the past week are as follows: "Orders came in freely, and the week was above the average." "It was an excellent week and the business was well distributed." "Business picked up quite a bit with us and we are putting on more men." The great majority of the manufacturers report that in the week the market showed considerable improvement and there are none who report a falling off in sales.

Selling agents report that there was a lull the first part of the week, but state that during the latter part of the week business was at a fair level. This branch of the trade reports that there is a large amount of business pending but that it is still difficult to close the orders.

Automobile manufacturers and concerns in the allied trades did an increased amount of buying in the week, but this was almost altogether confined to single tools and replacements. The great majority of the week's orders were placed by general machinists and miscellaneous users, located in all parts of the country, who purchased a well-diversified line of single tools. Purchases of railroads were also confined to single tools.

Nearly all concerns report the receipt of an increased number of inquiries, among which were some lists. A number of inquiries came from the automotive industry, but, as in the case of orders, the great majority were from general machinists and miscellaneous users, located in all sections of the country.

DETROIT

The machinery and machine tool market in the Detroit district is undergoing a process of balancing up which has brought about a slight reduction in the number and size of orders.

Inquiries, however, are still coming in and not only is the general atmosphere highly optimistic but there is a very sound reason for optimism. All of the automobile plants and all of the associated industries are running at top speed, and are busier than they have been for many months with the employment figures rising rapidly every week.

Nearly all of the small shops are busy and many of them are buying equipment. The body companies are doing some buying and many of them are making inquiries. The General Motors units are stepping up production as is the Ford Motor Company. Oakland, Pontiac, Buick and Chrevolet all are either in the market for new equipment or else have recently made purchases.

The general prosperity of the trade is all that was anticipated at the beginning of the year.

CANADA

A speeding up in the demand for mining machinery, and the placing of new railway equipment orders are outstanding features of the Canadian market. Orders recently placed by the Canadian National Railways cover passenger equipment, work equipment and snow ploughs, and the firms benefiting thereby are the National Steel Car Corporation, Ltd., Hamilton, Ontario; the Eastern Car Co., Ltd., New Glasgow, N. S., and the Canadian Car and Foundry Co., Ltd., Montreal. The Newfoundland Railway recently ordered two all-steel sleeping cars from the National Steel Car Corporation. It is understood the plans of the two principal railways call for further large purchases.

Steel mills are reported to be behind in filling orders and are running plants from 18 to 24 hr. per day. Iron and steel consumers, large and small, are finding competition keen, but the usual year's business is making its appearance as per schedule, and in larger volume than in past years. Double-shift operations are in force at the Algoma plants of the Lake Superior Corporation, and plans for the construction of a new structural steel plant have been announced.

Construction industries are very busy with an unusually large spring program. Road building machinery and equipment will be in good demand this year. In Ontario, the provincial Government plans to spend $8,300,000 on the construction of new highways; the Quebec Government's estimates include $6,000,000 for expenditure on roads, and each of the other provinces propose to improve roads.

Activity in farm implement demand is a feature of the general business situation in western Canada. Ontario fabrications lead in this market but a lot of business is going to Moline, Ill., Chicago, Detroit and Minneapolis concerns. All of these points have agencies or commercial men in the Prairie provinces just now.

Canadian Vickers, Ltd., has been awarded the tender for structural steel required by the Montreal Harbour Commissioners in eecting two new sheds. The D. MacKenzie Machinery Co., Guelph, Ont., report an exceptionally busy season. Recently they have shipped two of their new design shapers to Montreal, one special lathe to the General Electric Co., Peterborough Ont., and a large special cutting-off machine to Beatty Bros., Fergus, Ontario.

NEW ENGLAND

Most machinery and machine tool manufacturers approached in the New England section report a more satisfactory business in March than a year ago. Compared with January and February, March showed no general improvement from an order standpoint. Some very good lists for production machinery are still open, and would make a very appreciable difference in the valuation of business on hand.

New England industrial conditions continue to display an upward trend with one outstanding exception, the textile industry. Power utilities serving large industrial centers report substantial gains in the volume of power consumed in the first quarter of this year as compared with last year. Gratifying increases were particularly notable in the metal-working, rubber and paper industries. Only the textile industry showed a loss in load consumed.

Machine shops are well occupied with contract work, and a good demand is in evidence for small tools from this source. Extensive road construction in Maine, Massachusetts and Connecticut promises a good distribution of road-building machinery. Used-machinery dealers report an average volume of business for this period of the year.

INDIANAPOLIS

While the volume of machine tool and machinery business here fell down somewhat during the last fortnight from the previous equal period, the situation yet remains fair and the manufacturers and jobbers are convinced that the present situation is temporary. During the last of February and the first half of March the situation was particularly bright, with a large sales volume. A slump of two or three weeks means little in the season's average sales volume. It is believed that sales for March will exceed those of a year ago.

One of the brightest outlooks comes from the electric industry. Word from various parts of the state indicates that a big amount of replacing will be done during the present spring and summer and some expansions are contemplated. Generators, Diesel engines and similar large equipment is in prospect.

The last two weeks has seen a slump in demand for tools from the automobile industry. The body industry, however, seems in better standing with production going

at top speed and the plants making purchases of a wide variety of special equipment, both wood and metal. The demand from the steel industry also shows little life, but inquiries are numerous and some spring business is expected.

A fair demand already has started with the contractors, both building and road. This business is expected to be better during 1928 than 1927, particularly with the building contractors. It is likely the same thing will hold true with the road contractors, for many of them have been using equipment that is getting pretty ancient.

Some demand now is noticed for special garage equipment, particularly valve grinding machines, small lathes, small punch presses and like equipment. The future this year from this source seems particularly bright and the coming of spring should augment sales materially.

CHICAGO

The machine tool market for the last week has been without special feature. Business, while on a fairly active basis, is not of as large a volume as had been hoped for, and the month of March will close with the situation differing but little from that which has characterized the market for the last two or three weeks. No additional developments in railroad buying have been reported during the week. The Santa Fe is making brisk headway in the closing of the items still outstanding on on its lists. Other railroads at infrequent intervals are purchasing either single tools or small lots as needed.

The machine tool trade for the moment is largely depending on general industry, farm implement and tractor plants, and automotive and auto accessory manufacturers for the bulk of business. Inquiries are being received in good volume from widely different sources, but closing drags. Dealers in used tools report business as moderately active. Manufacturers of woodworking machinery report a considerable improvement in their line, and state that the outlook for the summer is encouraging.

Triple Mill Supply Convention Will Discuss Consolidation

At the meeting of the Mill Supply Council March 6, 1928, at which were present Messrs. Keeling, Larzelere and Smith, secretary of the Southern Supply & Machinery Dealers Association; Welles, chairman, Radcliffe, and Ackles, of the National Supply & Machinery Distributors Association; and Skinner, Brisbin, Williams, Payne of the American Supply Machinery Manufacturers Association, the associate membership of the National Supply and Machinery Distributors Association was discussed. It was found that through misunderstanding of the previous resolution these associate members had not yet been transferred to the A.S.&M.M.A. It was therefore decided that in accordance with the resolution of the National Association of January 19 this would be completed on or before the triple convention to be held May 15-17 at Nashville.

The Manufacturers Association reported considerable progress in the signatures of its membership blanks for dealer distribution and expressed its intention of continuing these efforts with a view to completing the work by the time of the triple convention and taking action as to its remaining membership immediately thereafter.

The convention program was next discussed. It was decided to have no outside speakers. The first day, May 15, is to be given over to separate executive sessions. Wednesday morning is to be devoted to a joint meeting of the three associations for the presentation of a review of the activities of the Mill Supply Council for the past year and a general discussion of the future of the three associations, with particular reference to the advisability of future consolidation of the three associations. On Wednesday afternoon the three associations will meet in executive session for discussion and determination of that question and of any other matters that may arise. Thursday morning there will be executive sessions for the election of officers, etc., to be followed by a triple joint meeting at 11 a.m. for the presentation of the new officers. That afternoon will be left open for the pleasure of those attending.

Secretary Davis Refutes Unemployment

Estimates in some quarters that there are 4,000,000 unemployed in the United States are refuted by Secretary of Labor James J. Davis, who places the actual number of jobless at 1,874,050, in his report to the Senate, as called for under a resolution by Senator Wagner of New York. The Secretary declared the present slump in employment serious, although not so grave as estimates generally circulated. His figures were based on a report by Ethelbert Stewart, commissioner of labor statistics, which accompanied the report. In attributing the causes for the large number of unemployed Mr. Davis named the floods in the Mississippi Valley, in New England, the tornado which swept Florida, temporary closing of a part of certain industrial plants, and the disturbance in the bituminous coal field, which has lasted many months.

National Acme Gets Ford Order

Announcement is made by the National Acme Co., Cleveland, Ohio, manufacturer of screw products, automatic screw machines, automatic threading dies, etc., that an order covering the complete manufacture of the Houdaille shock absorber, used on the new Ford cars, has been received by that company and that it is expected production eventually will reach about 4,000 shock absorbers a day.

Fellowship for Cast-Iron Research Created

An industrial fellowship for the continuation of research on cast iron has been established in the Mellon Institute of Industrial Research, Pittsburgh, Pa., by the Whiting Corporation, of Harvey, Ill. Dr. Edward E. Marbaker, holder of the fellowship, will conduct the research, it is announced by Dr. Edward R. Weidlein, director of the Mellon Institute. The results of these investigations will be published for the general benefit of the foundry industry. Dr. Marbaker will work in close co-operation with the American Foundrymen's Association. He has been a fellow of the Mellon Institute since 1921 and previously was chief chemist for the Westinghouse Lamp Co. and for the Cleveland Wire Division of the National Lamp Works of the General Electric Company.

James A. Carr Dies

James A. Carr, retired manufacturer of seeding machinery and widely known in industrial circles throughout the Middle West, died of apoplexy at his home in Richmond, Ind., recently, in his 72nd year. Mr. Carr became connected with the Hoosier Drill Co., of Dublin, Ind., in 1877 and was superintendent when the concern moved to Richmond. When the Richmond and four other plants were merged into the American Seeding Machinery Co. in 1903, he became vice-president and later president of the new company. He remained in that capacity until 1920 when the Hoosier Drill unit was sold to the International Harvester Co. He then retired from active business. Early in 1918 he was appointed chairman of the Allied Purchasing Co. in the United States. Serving as a dollar-a-year man, Mr. Carr and his associate members made purchases for the allied governments totaling billions of dollars. In recognition of his service the French government made him a chevalier of the Legion of Honor and Italy conferred upon him the decoration of officer of the order of Saints Maurizio e Lazaro.

Personals

W. I. S. HENDRIE has been chosen president of the Hamilton Bridge Co., Hamilton, Ontario, and Walter B. Champ, who was formerly vice-president, has also been named managing director of the company, a newly created office.

JAMES CAMERON ARMER has been appointed resident vice-president of the Dominion Forge and Stamping Co., Walkerville, Ontario. Mr. Armer, who has been connected with the company for the past nine years in the capacity of sales manager, will have charge of the Toronto and Montreal territories.

ROBERT P. DICKELMAN, formerly secretary of the Pressed Steel Tank Co., Milwaukee, has been elected vice-president, and Herman Merker has become sceretary. Mr. Merker also is sales manager and will continue in this position. Herman O. Brumder is president; George F. Brumder, vice-president, and F. Trevor Boundy, treasurer.

JUSTINE G. SMEBY recently has been appointed welding engineer at the South Philadelphia works of the Westinghouse Electric and Manufacturing Co. Mr. Smeby was graduated in 1922 from the University of North Dakota with the degree of B.S. in mechanical engineering. He entered the apprenticeship course at the South Philadelphia plant, later being transferred to the tool design division, then to the turbine engineering department.

W. W. TANGEMAN, of the Cincinnati Milling Machine Co., recently delivered an ex-

tended talk to members of the superintendents' and production managers' groups of the Industrial Management Council, Rochester, N. Y., on how the rapid development of the machine tool industry has lightened the physical burden formerly imposed upon employees in industry. R. B. Knight, chairman of the group, presided at the meeting which was attended by one hundred superintendents and production managers.

Business Items

The Yale & Towne Manufacturing Co., of Stamford, Conn., has filed notice of an increase in capital stock from $10,000,000 to $11,000,000 by the addition of 40,000 shares, par value $25.

The J. C. McAdams Co., Long Island City, N. Y., automobile accessory manufacturer, has leased a part of the plant formerly occupied by the Traut & Hine Manufacturing Co., in New Britain, Conn., owned by the North & Judd Company.

Leeds, Tozzer & Co., Inc., of 75 West St., New York, have been appointed distributors to the railroad industry of the Stuebing-Cowan hand and electric lift trucks and steel-bound platforms. The appointment is for all railroads, electric lines and steamship companies.

The Mideke Supply Co., of 100 East Main St., Oklahoma City, Okla., recently has been appointed to represent the Foote Bros. Gear & Machine Co., in its line of IXL speed reducers, gear products and general transmission machinery, in Oklahoma City and vicinity.

The Farmer Lubrication Systems, Inc., of Detroit, has been bought by interests in Battle Creek, Mich., and will be reorganized and removed to the latter city where production will be resumed at an early date. The lubricating system is applicable to machine tool cranes, printing presses and automotive vehicles.

Articles of incorporation have been filed for the Lafayette Steel Products, Inc., Lafayette, Ind., showing a capital stock of $375,000. The new concern is an amalgamation of the Myers Manufacturing Co., of Charleston, Ill., and the Metal Basket Works, of Lafayette and has purchased a factory in Lafayette for the manufacture of metal baskets, trunks for automobiles and other products. It is expected that the plant will be in operation by May 1, next.

Directors of the Frost Manufacturing Co., Galesburg, Ill., manufacturer of the Ross steel heating boilers, has elected Samuel M. Harrington, associated with the company 12 years, president, to succeed W. S. Cameron, resigned. Mr. Harrington's grandfather, Andrew Harrington, was one of the founders of the industry and his father, also Andrew Harrington, was secretary and treasurer, prior to 1916, when he died. The new president is the third generation of the family actively associated in the company.

The Twentieth Century Brass Works and the Cream of Wheat Co., both of Minneapolis, Minn., are moving machinery into new factories there representing a combined investment of more than $1,150,000 and annual payrolls of more than $500,000. Each announces an expansion program and scheduled increased production for 1928. W. A. Wright, president of the brass works, has announced the installation of modern machinery costing $50,000, and now being placed in the company's new building at 2601 East Hennepin Avenue.

Articles of incorporation for the Mid-States Steel and Wire Co. to take over the properties of one Michigan and two Indiana wire companies, valued at $1,696,407, have been filed with the secretary of state in Indianapolis by Dennis B. Hayes, of Detroit; James E. Van Deventer, of Anderson, and John Somner, of Peoria, Ill. Plants to be taken over are the Adrian Wire Fence Co., Adrian, Mich.; Dwiggins Wire Fence Co., Anderson, and the Crawfordsville Wire and Nail Co., Crawfordsville. Capital stock of the company consists of $950,000 preferred and $1,400,000 common stock.

The Dubuque Tractor & Truck Co. of which Paul Klum is president has been merged with the Vergan-Schmidt Co. of Champaign, Ill., and the Vergan-Schmidt Co. will be incorporated to continue manufacture of the two lines represented by the companies involved. The Illinois concern has been specializing in heavy construction and lumber yard equipment, including an improved crane on tractor carriage for lumber dealers, general construction, building and other heavy duties. The Vergan-Schmidt Co. has removed its entire plant equipment to the Dubuque Tractor plant.

The A. E. Staley Manufacturing Co., of Decatur, Ill., at its annual organization meeting named the following officers: A. E. Staley, Sr., president and general manager; E. K. Scheiter, first vice-president and assistant general manager; T. C. Burwell, first vice-president; Charles J. Schuster, secretary; A. E. Staley, Jr., treasurer; R. C. Augur, assistant secretary-treasurer. Arnold Stifel of Nicholas & Co., of St. Louis, and Henry Lockhart, Jr., of Blair & Co., of New York, representing bond houses which handled a recent Staley issue, were elected to the board of directors, succeeding J. H. Firestone, of Spencer, Ohio, and Albert Krause, of Marwood, Pa.

The Follen-Lorenz Tool Co., Kenosha, Wis., established in 1923 to manufacture special tools, dies, jigs, fixtures and bank and postal cancelling machines, will greatly enlarge its capacity, having recently acquired the former Marwin Motor Truck Co. plant of 35,000 sq.ft. A new department for metal stamping and deep drawing will be established. On June 1, Carl A. Strom becomes associated with the concern, the name of which is being changed to the Follen-Strom Manufacturing Co., James H. Follen is president and treasurer, and Mr. Strom becomes vice-president and general sales manager. E. Minderman becomes secretary. Fred Lorenz, a co-founder of the business, still retains an interest but has not been active in the affairs of the firm for some time.

Obituaries

JOHN JEWELL, 60 years old, treasurer of the Reeves Pulley Co., of Columbus, Ind., died recently of heart trouble. He had been with the company since 1887. Three years ago he was named treasurer.

J. L. COX, president of the Cox Foundry & Machine Co., Atlanta, Ga., and identified for a number of years with the foundry and machinery industries in the southeastern district, died recently at the age of 51 years, following a brief illness. Mr. Cox's death was indirectly due to severe injuries he suffered in an automobile accident several months ago.

PETER J. MCNAMARA, 77 years old, native of Ireland, founder and president of the McNamara-Koster Foundry Co. of Indianapolis, died recently, following a short illness. He founded the foundry company with Louis Koster in 1890. Recently Mr. Koster sold his interests to the sons of Mr. McNamara and the company was being reorganized under the name of McNamara & Sons.

HARRY L. BELL, 70 years old, former resident of Mishawaka, Ind., died recently at his resort home on Bass Lake, near Knox, Ind., following a prolonged illness. Mr. Bell was superintendent of the foundry department of the Dodge Manufacturing Corporation and was an expert metallurgist. He was one of the experts engaged in the original construction of the Amplex motor in Mishawaka some years ago.

JOHN T. CORBETT, who organized and for many years headed Stadler & Corbett, boiler manufacturers in Aurora, Ill., died recently at his home in Aurora after a long illness. Leaving the Aurora firm he became head of the boiler department of the Joseph T. Ryerson Co. of Chicago, serving that concern more than 20 years, in that capacity, until his retirement eight years ago. He was 77 years of age.

WILLIAM MELVILLE BOWMAN, president of the Somersworth Foundry Co., Salmon Falls, N. H., died suddenly on March 24. Mr. Bowman was 67 years old, a native of Falmouth, Mass.; and, before coming to Salmon Falls in 1900 was connected with the Walker-Pratt Co., of Boston, Mass., and previously was a part owner of a foundry in Taunton, Mass. His son, Harold M. Bowman, superintendent of the foundry, and his widow survive.

Forthcoming Meetings

American Gear Manufacturers' Association. Twelfth annual meeting, Rochester, N. Y., April 19, 20 and 21, Hotel Seneca. T. W. Owen, secretary, 3608 Euclid Ave., Cleveland, Ohio.

American Welding Society. Annual meeting, week of April 23, New York City. M. M. Kelly, secretary, 33 West 39th Street, New York City.

National Metal Trades Association. Thirtieth annual meeting, Hotel Astor, New York, April 25 and 26. J. E. Nyham, secretary, Peoples Gas Bldg., Chicago, Ill.

National Foreign Trade Council. Fifteenth anniversary convention, Houston, Texas, April 25, 26 and 27. O. K. Davis, secretary, India House, Hanover Square, New York.

American Society of Mechanical Engineers. Spring Meeting, May 14-16, Pittsburgh, Pa. Calvin W. Rice, secretary, 39 West 39th St., New York City.

American Foundrymen's Association. Convention and Exhibit, Philadelphia, May 14 to 18. Technical Sessions at Hotel Belleview-Stratford; exhibit at Commercial Museum. R. E. Kennedy, secretary, 140 So. Dearborn St., Chicago.

Southern Supply & Machinery Dealers' Association. Will meet in annual convention in Nashville, Tenn., May 15, 16 and 17 jointly with the **National Supply & Distributors' Association** and the **American Supply & Machinery Manufacturers' Association.**

National Association of Purchasing Agents. Annual meeting and "Informashow," Kansas City, Mo., May 28 to 31. W. L. Chandler, secretary, 11 Park Place, New York.

American Railway Association. Schedule of sectional meetings: Division V, Mechanical, June 13 to 20, Atlantic City, N. J.; Division VI, Purchases and Stores, June 13 to 15, Atlantic City, N. J. Division VII, Electrical, Sept. 22 to 28, Cleveland, Ohio. J. W. Welsh, secretary, 292 Madison Avenue, New York City.

Association of Iron and Steel Electrical Engineers. Annual meeting, Stevens Hotel, Chicago, June 25 to 29. J. F. Kelly, managing director, Empire Bldg., Pittsburgh, Pa.

American Society for Testing Materials. Annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J., June 25 to 29. C. L. Warwick, secretary, 1315 Spruce St., Philadelphia, Pa.

Society of Automotive Engineers. 1928 Summer Meeting, Chateau Frontenac, Quebec, Canada, June 26 to 29. C. E. Heywood, in charge of meetings, 29 West 39th St., New York.

American Railway Tool Foremen's Association. Annual meeting, Hotel Sherman, Chicago, Sept. 12, 13 and 14. G. G. Macina, secretary, 11402 Calumet Ave., Chicago.

American Railway Tool Foreman's Association. Sixteenth annual convention of the Supply Association, Hotel Sherman, Chicago, Sept. 12, 13 and 14. F. A. Armstrong, secretary, the Pratt & Whitney Co., 564 W. Monroe St., Chicago.

National Safety Council. Seventeenth annual safety congress will be held in New York, October 1-5. Idabelle Stevenson, executive secretary, 1 Park Ave., New York.

American Society for Steel Treating. "National Metals Exposition," Commercial Museum, Philadelphia, Pa., week of Oct. 8. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

The Weekly Price Guide

Rise and Fall of the Market

WITH scrap iron and steel down an average 25c. per ton, this week and coke prices soft, little hope is extended for higher pig-iron prices in the immediate future. Steel, however, holds firmly to the quotation of $1.90 per 100 lb. on bars, shapes and plates, base, Pittsburgh in quantities running from single carloads to large mill lots, in current buying. Increasing demand is in evidence for car material, steel rails and gas and oil line pipe. Firmness in most of the non-ferrous metals is reflected in an advance of ¾c. in solder and 2c. per lb. in highest grade babbitt, during the last week at New York warehouses. Prices for scrap brass and zinc are also higher. Wiping cloths, after an advance last week and one during the week preceding, are now down 1¾c. per lb., owing largely to imports.

(All prices as of March 30)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$21.44
Northern Basic	20.89
Southern Ohio No. 2	21.19
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	25.62
BIRMINGHAM	
No. 2 Foundry	16.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	21.76
Virginia No. 2	27.17
Basic	21.26
CHICAGO	
No. 2 Foundry local (silicon 1.75@2.25)	20.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	22.80
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	20.26
Basic	19.26
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.50@4.75
Cleveland	5.00
Cincinnati	4.30
New York	5.25
Chicago	4.50@4.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.00@2.10	3.50	3.25	3.89
No. 12	2.05@2.15	3.55	3.30	3.94
No. 14	2.10@2.20	3.60	3.35	3.99
No. 16	2.20@2.30	3.70	3.45	4.09
Black				
Nos. 18 to 20	2.60@2.70	3.75	3.55	4.00
No. 22	2.75@2.85	3.90	3.70	4.15
No. 24	2.80@2.90	3.95	3.75	4.20
No. 26	2.90@3.00	4.05	3.85	4.30
No. 28	3.05@3.15	4.20	4.00	4.45
Galvanized				
No. 10	3.05	4.10	3.90	4.25
Nos. 12 to 14	3.15	4.20	4.00	4.35
No. 16	3.25	4.30	4.10	4.45
No. 18	3.40	4.45	4.25	4.60
No. 20	3.55	4.60	4.45	4.75
No. 22	3.60	4.65	4.50	4.80
No. 24	3.75	4.80	4.60	4.95
No. 26	4.00	5.05	4.85	5.20
No. 28	4.25	5.30	5.10	5.45

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	54%	41%
2½ to 6 in. steel lap welded	48%	35%	53½%	40½%	51%	38%

WROUGHT STEEL PIPE LIST

Size, Inches	List Price per Foot	—Diameter in Inches— External	Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb.:

—Thickness— Decimal	B.w.g. and Fractions	Outside Diameter in Inches ⅛	¼	⅜	½	⅝	¾	⅞	1	1⅛	1¼
		Price per Foot									
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23			
.049"	18	.17	.18	.19	.20	.21	.23	.25			
.065"	16	.19	.20	.21	.22	.23	.25	.27			
.083"	14	.20	.22	.23	.24	.25	.27	.29			
.095"	13	.21	.23	.25	.26	.27	.29	.31			
.109"	12	.22	.24	.26	.27	.28	.30	.32			
.120" or .125"	11	.23	.25	.27	.28	.29	.31	.33			
.134"	10	.24	.26	.28	.29	.30	.32	.34			

MISCELLANEOUS—Warehouse base prices in cents per lb.:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	4.65	4.65
Spring steel, heavier	4.00	4.00	4.00
Coppered Bessemer rods	6.05	6.00	6.20
Hoop steel	4.49	4.00	4.15
Cold rolled strip steel	6.25	6.00	6.10
Floor plates	5.25	5.30	5.00
Cold drawn, round or hexagon†	3.40	3.65	3.60
Cold drawn, flat or square†	3.90	4.15	4.10
Structural shapes	3.34	3.00	3.10
Soft steel bars	3.24	3.00	3.00
Soft steel bar shapes	3.24	3.00	3.00
Soft steel bands	3.99	3.65	3.65
Tank plates	3.34	3.00	3.10
Bar iron (2.75 at mill)	3.24	3.00	3.00
Drill rod (from list)	60%	55%	50%

*Flat, 3/16@½-in. thick. †Cold finished steel, shafting and screw stock.

Electric welding wire, New York, 3/32, 8.35c.; ⅛, 7.85c.; 5/32 to ½ 7.35c. per lb.

METALS

Warehouse Prices in Cents Per Pound for Small Lots.			
Copper, electrolytic, New York			15.50
Tin, pigs, New York			54.75
Lead, pigs, E. St. Louis	5.85	New York	6.62½
Zinc, slabs, E. St. Louis	5.67½	New York	6.62½

	New York	Cleveland	Chicago
Antimony, slabs	12.50@13.00	13.25	14.25
Copper sheets, base	22.75	22.75	22.75
Copper wire, base	19.37½	19.37½	16@16¼*
Copper bars, base	21.25	21.25	22.25
Copper tubing, base	24.50	24.50	24.50
Brass sheets, high, base	18.75	18.75	18.75
Brass tubing, high, base	23.62½	23.62½	23.62½
Brass rods, high, base	16.50	16.50	16.50
Brass wire, high, base	19.25	19.50	19.25

*Mill.

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%.....	27@28	22¾@24*	24.03*
Zinc sheets (casks).....	10@10½	12.65	10.36
Solder (½ and ½), (case lots).....	34.00	32.50	33@37
Babbitt metal, delivered, New York, cents per lb.:			
Genuine, highest grade.....			71.00
Commercial genuine, intermediate grade.....			57.00
Anti-friction metal, general service.....			31.50
No. 4 babbitt (f.o.b.).....			12.00
Nickel, f.o.b. refinery, cents per lb.:			
Ingots..... 35.00	Electrolytic.. 37.00	Shot.....	36.00

*F.o.b. producing point.

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Full finished nickel sheet (base).....	52.00
Cold rolled nickel sheet (base).....	60.00
Hot rolled rods, Grade "A" (base).....	45.00
Cold drawn rods, Grade "A" (base).....	53.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot.....	28.00	Hot rolled rods (base)...	35.00
Blocks.....	28.00	Cold drawn rods (base)..	43.00
Cold rolled sheets (base)	50.00	Full finished sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible copper.....	12.25 @12.50	11.50	11.25@11.75
Copper, heavy, and wire.	11.50 @12.25	10.75	10.75@11.25
Copper, light, and bottoms	10.25 @10.75	9.50	9.50@10.00
Heavy lead.....	4.75 @ 5.00	5.25	4.25@ 4.75
Tea lead.....	3.50 @ 3.75	3.75	3.25@ 3.75
Brass, heavy, yellow.....	7.12½@ 7.37½	7.25	7.00@ 7.50
Brass, heavy, red.....	9.00 @ 9.50	9.75	9.00@ 9.25
Brass, light.....	5.50 @ 5.75	5.75	6.00@ 6.50
No. 1 yellow rod turnings.	7.50 @ 8.00	7.50	7.00@ 7.50
Zinc.....	3.25 @ 3.50	3.25	2.50@ 3.00

TIN PLATES—Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20.....	$12.10	$11.95	$11.50
"A" Grade:				
IC,	14x20.....	9.70	9.90	9.50
	Coke Plates—Primes—Per box			
100-lb.,	14x20.....	6.10	6.10	7.00
	Terne Plates—Small lots, 8-lb. Coating—Per box			
IC,	14x20.....	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.‡	$0.10@0.13½	$0.16	$0.15
Cotton waste, colored, per lb.‡	.09@ .13	.12	.12
Wiping cloths, washed white, per lb.....	.15@.17½	38.00 per M	.15
Sal soda, per lb.....	.02	.02	.02¾
Roll sulphur, per lb.....	.027	.03½	.04
Linseed oil, raw, per 7½-lb. gal., 5 bbl. lots.....	.76½	.84	.78
Lard cutting oil, 25% lard, in 5 gal. cans, per gal....	.65	.50	.50
Machine oil, medium-bodied (55 gal. steel bbl.) per gal.....	.27	.36	.26
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin.ft. per inch of width for single ply.			
Medium grade.....	35%	35%	35%
Heavy grade.....	30%	30%	30%
Rubber transmission, 6-in., 6 ply, $1.83 per lin.ft.			
First grade.....	45%	50–10%	50%*
Second grade.....	50%	60–5%	50–10%†

*Large quantities, 60%. †Large quantities, 60–10%. ‡Bale lots.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars.....	per lb....	$0.0324	$0.0324	$0.0324
Cold drawn shafting....	per lb....	.034	.034	.04
Brass rods.....	per lb....	.165	.165	.161½
Solder (½ and ½).....	per lb....	.34	.335	.42
Cotton waste, white....	per lb....	.10@.13½	.10@.13½	.10@.13½
Emery disks, cloth, No. 1, 6-in. dia.....	per 100...	3.10	3.10	3.10
Lard cutting oil.....	per gal...	.65	.65	.55
Machine oil.....	per gal...	.27	.27	.33
Belting, leather, medium.....	off list....	35%	35%	40–5%
Machine bolts, up to 1x30 in., full kegs....	off list....	50%*	50%*	50%*

*List prices as of April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
*Flint paper.....	$5.40	$4.95	$5.13
*Emery paper.....	10.71	9.15	10.71
*Emery cloth.....	27.84	27.85	27.84
Emery disks, 6 in. dia., No. 1, per 100:			
Paper.....	1.29	1.27	1.32
Cloth.....	3.10	3.05	3.05
Fire clay, per 100 lb. bag.....	1.00	.75	.75
Coke, prompt furnace, per net ton...	Connellsville, 2.65@3.00		
Coke, prompt foundry, per net ton...	Connellsville, 3.75@4.50		
White lead, dry or in oil....	100 lb. kegs....	New York, 13.75	
Red lead, dry.....	100 lb. kegs....	New York, 13.75	
Red lead, in oil.....	100 lb. kegs....	New York, 15.25	

*4½ reams and under.

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

	Full Kegs or Cases
Machine bolts, square heads and nuts:	
Up to ¾ x 6-in.....	55%
Larger up to 1 x 30-in.....	50%
1¼ and 1½ in. dia.....	35%
Carriage bolts:	
Up to ½ x 6-in.....	55%
Larger sizes.....	50%
Coach and lag screws:	
Up to ½ x 6-in.....	55%
Larger sizes.....	50%
Tap bolts, hexagonal heads.....	40%
Nuts:	
Hot pressed, square and hexagonal, blank or tapped, up to 1-in., incl.....	55%
Cold punched, square and hexagonal, blank or tapped, up to 1-in. incl.....	55%
Semi-finished, hexagonal, tapped, in packages, all sizes.....	40%
Case hardened, hexagonal, tapped, in packages, all sizes.....	30%
Washers: Deduct from list, per 100 lb.....	$3.50*
Rivets, button and cone head:	
Small, including ⅞-in. dia.....	50–10%
Large (base) per 100 lb. net.....	$5.00†

Note—For less than case or keg quantities on bolts, screws, hot-pressed and cold-punched nuts, add extra of 10 per cent to list.
*Broken keg lots, $1.50 off list. †Broken keg lots, $6.50 net.

Machine Requirements and Industrial Construction

Equipment Wanted

Ill., Chicago—Capitol Plumbing & Heating Supply Co., M. B. Kaplan, 731 North Wells St.—8 in. pipe threading machine.

Mich., Detroit—Briggs Mfg. Co., 11631 Mack Ave.—machinery and equipment for assembling auto body parts for proposed 3 story, 25 x 130 ft. addition to auto parts factory. Estimated cost $40,000.

Mich., Detroit—R. Runde, 1619 Twenty-third St.—milling machine.

Mich., Detroit — White Motor Co., 842 East 79th St., Cleveland, O.—machinery and equipment later for proposed 1 story, 190 x 200 ft. sales and service station on Twelfth St. here. Estimated cost $150,000.

Mich., Detroit—Wolverine Iron Works, 6782 Goldsmith Ave.—electric welding equipment.

Mich., Muskegon—Accuralite Co., 722 Terrace—machine equipment for finishing piston rings for proposed 1 story, 80 x 200 ft. factory. Estimated cost $50,000.

Mich., Saginaw—Saginaw Malleable Iron Works—core shop equipment, etc. for proposed 1 and 2 story, 82 x 90 and 40 x 80 ft. addition to foundry.

O., Cleveland—Bd. of Education, East 6th St. and Rockwell Ave.—one wood turning lathe, 7 ft. bed, one wood turning lathe, 4 ft. bed, one gear lathe, one 12 in. hand jointer, one 30 in. band saw, one variety saw bench two electric grinders and one portable sanding machine for new Alexander Hamilton Jr. high school.

O., Salem — National Sanitary Co. D. T. McNabb, Purch. Agt.—machinery and equipment for the manufacture of enameled iron bathtubs for proposed factory. Estimated cost $100,000.

Tex., Dallas—J. E. Mitchell & Co., 600 South Sixth St., St. Louis, Mo.—woodworking machinery for proposed 2 story, 100 x 300 ft. assembly plant for cotton cleaning machinery here. Estimated cost $100,000.

Ont., Ingersoll—Ingersoll Machine & Tool Co., King St. W.—machinery and equipment for proposed 50 x 105 ft. machine shop and 25 x 40 ft. heat treating rooms. Estimated cost $10,000.

Ont., London—Machine & Tool Co., 88 Fullarton St., G. Gunn, Mgr.—complete equipment for machine shop and foundry recently acquired. Estimated cost $40,000.

Ont., Toronto—Sully Brass Foundry Ltd. —machinery and equipment for recently acquired plant.

Opportunities for Future Business

Ala., Birmingham — American Bolt Co., 3830 Tenth Ave., plans extensions and improvements to plant to increase the capacity.

Calif., Sacramento—Continental Can Co., 155 Montgomery St., San Francisco, plans the construction of a factory here. Estimated cost $100,000.

Col., Pueblo—A. P. Devore, 810 Palmer Ave., plans the construction of a factory for the manufacture of airplane engines and airplanes. Estimated cost $100,000.

Conn., Hartford — Connecticut Co., 185 Church St., New Haven, is receiving bids for a 1 story, 97 x 130 ft. garage, etc. on Vernon St. here. Estimated cost $60,000. R. W. Fotte, 185 Church St., New Haven, Archt. Noted Mar. 22.

Conn., New Britain—Fafnir Bearing Co., Booth St., is having plans prepared for addition to plant including hardening room, etc. on Myrtle St. Estimated most $40,000. Private plans.

Ga., Atlanta—Atlanta Textile Supply Co., Austell Bldg., manufacturers of textile mill equipment, plans the construction of a plant including foundry, shops, etc. Estimated cost $30,000.

Ill., Chicago — Chicago Bridge & Iron Works, 1305 West 105th St., plans the construction of a 1 story, 100 x 200 ft. factory. Estimated cost $20,000. E. E. Michaels, 1305 West 105th St., Archt.

Ill., Chicago—Glabman Bros., 832 Maxwell St., manufacturers of furniture, awarded contract for a 4 story, 50 x 100 ft. factory at Morgan and Peoria Sts. Estimated cost $150,000. Noted Feb. 2.

Ill., Chicago—E. M. Laird Airplane Co., 4500 West 83rd St., is having sketches made for the construction of a machine shop. Private plans.

Ill., Chicago—Rapid Roller Co., 812 West Austin Ave., manufacturers of printers rollers, awarded contract for a 3 story, 100 x 125 ft. factory at 2548 South Federal St. Estimated cost $250,000. Noted Feb. 2.

Ia., Muscatine—American Process Co., C. T. Larson, V. Pres., manufacturers of trubo coal pulverizing machines, plans the construction of a 1 story, 100 x 150 ft. factory.

Mass., Boston—J. Shapiro, plans the construction of a 3 story, 115 x 360 ft. garage at 176 Ipswich St. Burtis Brown, 65 Franklin St., Engr. U. S. Post Office Dept., lessee.

Mass., Brighton (Boston P. O.)—Boston Buick Co., c/o E. B. Stratton, 25 Arch St., Boston, Archt., awarded contract for a 1 story, 60 x 170 ft. repair and service garage at 1172 Commonwealth Ave., here. Estimated cost $45,000.

Mass., Cambridge — Cambridge Auto Forge, F. J. Steeves, Sydney St., awarded contract for a 1 story repair shop. Estimated cost $40,000.

Mass., Lawrence—Lawrence Gas & Electric Co., 370 Essex St., awarded contract for a 2 story addition to factory on Marston St. Estimated cost $40,000.

Mass., Webster—Watertown Co., Tracy Court, will build a 2 story, 70 x 95 ft. auto body factory. L. J. Chafee, Oxford, Archt. Noted Mar. 22.

Mich., Battle Creek—Consolidated Sign Co., 99 West Main St., awarded contract for a 2 story, 50 x 250 ft. factory on Elm St. Estimated cost $75,000.

Mich., Grand Rapids—I. Ginrich & Sons, 216 Fulton St. W., is receiving bids for a 2 story, 78 x 228 ft. garage on Cherry St. Estimated cost $50,000.

Mich., Grand Rapids—Kinsey Motors Inc., 105 Sheldon S.E., is receiving bids for a 1 story, 100 x 165 ft. garage and sales and service station on Cherry St. Estimated cost $75,000. Benjamin & Benjamin, 35 Wenham Bldg., Archts.

Mich., Jackson—Sparks Withington Co., awarded contract for a 2 story, 60 x 260 ft. radio plant on LeRoy St.

Mich., Monroe—Monroe Industrial Comn., J. Weisel, 24 East Front St., is having plans prepared for an airplane landing field including the construction of repair shops, hangars, etc.

Minn., Minneapolis—Kremer Motor Co., 1518 Hennepin Ave., will soon receive bids for a 1 story, 150 x 154 ft. repair and service garage at 27th St. and Hennepin Ave. Estimated cost $100,000. P. E. Crosier, 916 New York Life Bldg., Archt. Noted Dec. 8.

N. J., Audubon (Camden P. O.)—Audubon Wire Cloth Co., R. Korb, Pres., awarded contract for a 2 story, 54 x 98 ft. factory.

N. J., Newark — Hygenic Tube Co., H. Lermer, Pres., 88 McWhorten St., awarded contract for 1 story, 52 x 125 and 13 x 40 ft. factory buildings at Ave. L and Mary St. Estimated cost $40,000. Noted Dec. 15.

N. J., Paterson—Cowego Realty Co., L. Gottlieb, Pres., 49 East 27th St., is receiving new bids for a 1 story, 215 x 250 ft. garage and service station on Ellison Pl. Estimated cost $250,000. E. A. Sleight, 136 Washington St., Archt. Former bids rejected. Noted Mar. 22.

N. Y., Binghamton—Fairbanks Valve Co., Birmington or c/o Fairbanks, Co., 393 Lafayette St., New York, plans the construction of a 2 story factory on Glenwood Ave. Estimated cost $100,000.

N. Y., Brooklyn — F. Buoniconto, 1319 84th St., had plans prepared for a 1 story, 100 x 100 ft. garage at 60th St. and 13th Ave. Estimated cost $40,000. H. F. Cassab, 191 Joralemon St., Archt.

N. Y., Buffalo—Trico Products Corp., 624 Ellicott St., manufacturers of automobile accessories, awarded contract for the construction of a factory. Estimated cost $250,000.

N. Y., New York—Dolce Construction Corp., J. Boshen, Pres., 261 Broadway, will build a 2 story, 94 x 125 ft. garage at Mott Ave. and 138th St. Estimated cost $75,000. Moore & Landsiedel, 148th St. and Third Ave., Archts.

N. Y., New York—Jakap Realty Corp., J. Koplan, Pres., 1431 Broadway, plans the construction of a 100 x 143 ft. garage at Tremont and Mayflower Aves. Estimated cost $45,000. F. J. Ross, 3954 White Plains Ave., Archt.

N. Y., New York—W. A. Taylor Building Co., B. D. Taylor, Pres., 824 Morris Ave., will build a 2 story, 100 x 100 ft. garage at Jerome Ave. and 174th St. Estimated cost $40,000. C. Schaefer, 332 East 149th St., Archt.

N. C., Sanford — Makepeace Mill Work Co., plans the construction of a new 75 x 150 ft. plant to replace plant of the Makepeace Box & Lumber Co., recently destroyed by fire. Estimated cost $40,000.

N. D., Bismarck—Stair Motor Co., R. V. Stair, Pres., 606 Main St., will soon receive bids for the construction of a 1 story, 100 x 100 ft. repair and service garage at Seventh St. and Broadway. Estimated cost $40,000. Van Horn & Ritterbush Bros., 209 Seventh St., Archts.

O., Cincinnati—The Ferro Concrete Co., Third and Elm Sts., awarded contract for a 9-story 100 x 200 ft. garage at Third and Walnut Sts. Estimated cost $1,000,000.

O., Zanesville—White Chevrolet Co., H. White, is having plans prepared for a 5 story garage on South Sixth St. Estimated cost $100,000.

Pa., Philadelphia—E. H. Reuss, Jr., 30th and Race Sts., (heating contractors) will soon award contract for a 2 story, 50 x 347 ft. shop, etc. at 49th St. and Grays Ave. P. H. Johnson, Weidner Bldg., Archt.

Pa., Philadelphia — Richmond Machine Co., Richmond and Winsley Sts., awarded contract for a 1 story, 50 x 100 ft. machine shop.

S. C., Charleston—Aldrich Machine Works, manufacturers of textile mill specialties, mill machinery parts, etc. awarded contract for the reconstruction of plant recently destroyed by fire.

Tex., Waco—D. June Machinery Co., awarded contract for the construction of a foundry at 208 South First St.

Va., Hampton Roads—Bureau of Yards & Docks, Navy Dept., Washington, D. C., awarded contract for the construction of a shop at Naval Operating Base (Air Station) here. Estimated cost $159,018.

Wis., Wausau—Bluhm Cab Co., Frank Bluhm, Pres., 410 Washington St., will soon award contract for a 2 story, 60 x 60 and 37 x 60 ft. repair and service garage. H. C. Manecke, c/o Wausau Iron Works, Archt.

Wis., Wausau—Northern Chevrolet Co., O. C. Schmelter, Pres., plans the construction of a 2 story repair and service garage. Architect not selected.

Ont., Hamilton—The Gartshore Thomson Pipe & Foundry Co., awarded contract for addition to plant on Caroline St. Estimated cost $50,000.

Ont., Toronto—Reid & Brown Structural Steel & Iron Works, 63 Esplanade St. E., plans the construction of a steel fabricating shop on Fleet St. Estimated cost $200,000. Private plans.